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Building Research

THE JOURNAL OF THE BUILDING RESEARCH INSTITUTE | JANUARY-MARCH 1968

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Building Research

The journal of building science, dedicated to the advancement of the science and technology of building

5, NUMBER 1

Y-MARCH 1968

HE NEXT ISSUE . . .

The April-June issue of BUILDING RESEARCH will contain selected technical papers from the BRI 1967 Fall Conferences.

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ROBERT P. DARLINGTON, AIA

BRI ADVISORY PANEL

ROBERT M. ENGELBRECHT, AIA
Chairman

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BUILDING RESEARCH, the Journal of the Building Research Institute, is published quarterly by the Building Research Institute, Inc., a non-profit technical society, 1424 Sixteenth Street, N.W., Washington, D. C. 20036. BRI members receive BUILDING RESEARCH as a member service. Subscription rate to non-members: $35.00 annually; $9.00, single copy. Special rate for college, university, and public libraries: $20.00 annually. All subscriptions payable in advance in U.S. funds. No discounts. Additional copies to BRI members or employees of member organizations: $12.00 annually; $3.50 single copy. © Building Research Institute, Inc., 1968. All rights reserved. Views and opinions expressed in this journal do not necessarily represent those of the Building Research Institute.

Building Science News

BRI Moves Offices

On Friday, December 29, 1967, the Building Research Institute moved its Washington headquarters from 1725 DeSales Street, N.W. The new address is 1424 16th Street, N.W., Washington, D. C. 20036.

The new location is a ten-minute walk from the previous address, and is conveniently located two blocks from three major hotels: The Gramercy Inn, Holiday Inn, and the Executive House.

BRI members and friends are invited to visit our offices whenever they are in Washington.

1968 Institute Officers Elected

The BRI Board of Directors, at its meeting on November 13, 1967, in the Mayflower Hotel, Washington, D. C., elected officers for 1968. President is Gershon Meckler, Vice President, Environmental Systems Corporation, Conyers, Georgia. Vice Presidents are Dan E. Morgenroth, Manager, Technical Sales, Owens-Corning Fiberglas Corporation, Toledo, Ohio, and Ben H. Evans, Director of Education and Research Programs, The American Institute of Architects, Washington, D. C. Mr. Morgenroth was also named as Vice Chairman of the Executive Committee.

Treasurer is Rudard A. Jones, Director, Small Homes Council—Building Research Council, University of Illinois, Urbana, Illinois. Named as members of the BRI Executive Committee, in addition to the above officers, are Joseph A. Rorick, Director of Operations, Eastern Division, IBM Corporation, White Plains, New York, and Edward T. Schreiber, President, Construction Consultants, Inc., Detroit, Michigan.

Pictures and biographies of these officers are on pages 8-10.

Membership Elects Board Members

At the Annual Meeting of the Building Research Institute on November 15, 1967, in the Mayflower Hotel, Washington, D. C., the BRI membership elected ten members of the Board of Directors. Four current Board members were reelected to three-year terms: Robert F. Hastings, President, Smith, Hinchman & Grylls Associates, Inc., Architects and Engineers, Detroit, Michigan; Gershon Meckler; Joseph A. Rorick; and Edward T. Schreiber.

Four persons were elected to three-year terms as new members of the Board of Directors: Stewart D. Barradale, Manager, Construction Research Department, Research Division, Weyerhaeuser Company, Seattle, Washington; Harold C. Bernhard, Partner, Shreve, Lamb & Harmon Associates, Architects, New York, New York; Frank A. Biberstein, Professor and Head, Department of Civil Engineering, The Catholic University of America, Washington, D. C.; and Joseph H. Newman, Vice President, Tishman Research Corporation, New York, New York.

Robert A. LaCosse, Technical Director, Insulation Board Institute, Chicago, Illinois, was elected for a two-year term, and William F. Reardon, Manager-Engineering, Real Estate and Construction Operation, General Electric Company, Schenectady, New York, was elected for a one-year term.

Pictures and biographies of the new Board members are on pages 10-12.

Journal Becomes Quarterly

The BRI Board of Directors has authorized a change in the publishing schedule of BUILDING RESEARCH from bi-monthly to quarterly. The current issue (Volume V, Number 1) is the first in the new series. Volume IV (1967) consisted of five bi-monthly issues. The Journal was not published in November-December.

In the future, because of the reduction in the number of issues annually, BUILDING RESEARCH will increase in size and in coverage. Editorial policies, and the Journal's dedication to the advancement of the science and technology of building, will remain unchanged.

Subscribers who are not members of the Building Research Institute should note that subscriptions are now being accepted on a calendar year basis only, Previous subscription rates remain in effect.

Darlington Named Acting Executive Vice President

Robert P. Darlington, AIA, has bee named Acting Executive Vice Presider of the Institute, effective January 1968. Mr. Darlington served as Tech nical Director from 1963 to 1966, an for the latter half of 1967 was Technica Consultant to the Institute.

He replaces J. Anthony Vilar, wh resigned as Executive Vice President t accept the position as Managing Edito of a leading architectural and buildin magazine, BUILDING CONSTRUCTION, wit offices in Chicago, Illinois.

Institute Schedules Major Conferences

In response to President Meckler's r solve to make the Building Research I stitute of more immediate value to th building industry, the Institute has d veloped plans for three major co ferences in the first half of 1968.

On March 27-28, a Conference o Totally Manufactured Building Mo ules: The Case for Instant Space, wi be presented at the Conrad Hilton Hot in Chicago, Illinois.

The intent of this conference is define the concepts and the tec nological capability and potential U.S. industry in this dynamic new fiel

Following the "Instant Space" co ference, the Institute will present i annual Spring Conferences, April 2 25, at the Mayflower Hotel, Washin ton, D. C.

Five programs will be featured: I novation in Building Construction; T Office Building; Designing for the Ha dicapped; A New Look at Constructi Sealants; and Floor-Ceiling Systems.

During the first week in June, anoth special conference will be presented Housing the Developing Nations. addition to providing a measure of r lief for a large segment of the world poor, large-scale, low-cost housing co tains a tremendous potential for U. industry. This conference will prese current concepts and programs, and w develop statements on practical, i mediate programs and their potentia

Detailed information on each of the programs may be requested from B Conferences, 1424 16th Street, N.W Washington, D. C. 20036.

In the early planning stages is Conference on Air Rights tentative scheduled for presentation next Octob in Washington, D. C.

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BRI 1968 Conferences Schedule

Special Conference on Totally Manufactured Building Modules: The Case for Instant Space. March 27-28, Conrad Hilton Hotel, Chicago, Illinois.

- Session I: Designers and Design Concepts
- Session II: Manufacturers and Manufacturing Technology
- Session III: Ancillary Techniques
  Transportation
  Siting, Placing and Connecting
  Environmental Conditioning
  Financing

1968 Spring Conferences. April 23-25, Mayflower Hotel, Washington, D. C.

- Conference on Innovation in Building Construction, April 23
- Conference on The Office Building, April 23-24
- Conference on Designing for the Handicapped, April 25
- Conference on Floor-Ceiling Systems, April 25
- Conference on A New Look at Construction Sealants, April 25

Special Conference on Housing the Developing Nations. June 4-5, Hotel America, Washington, D. C. Discussion areas:

- Existing conditions
- Problems of housing finance; financial institutions; international financial assistance
- Political, social and economic issues
- Technology of housing methods and materials
- Research on international housing
- Legal and business problems; guaranties and insurance programs available to U.S. companies

In preparation: **Special Conference on Air Rights,** October, Washington, D. C.

R. Buckminster Fuller to Receive First BRI Fellowship

An event of major significance to the Building Research Institute will take place on Tuesday, April 23, 1968, during the BRI 1968 Spring Conferences. At a special luncheon at the Mayflower Hotel, Washington, D. C., on that day, R. Buckminster Fuller will be invested as the first Fellow of the Institute.

The award to Mr. Fuller will be the first in a BRI program to honor people who have contributed in a significant and creative way to the advancement of the science and technology of building.

During the opening program of the three-day 1968 Spring Conferences, the Conference on Innovation in Building Construction, on the morning of April 23, Mr. Fuller will deliver a major address on the subject of innovation and its place in the building world.

Bucky Fuller is world-renowned as the developer of the original Dymaxion House; the inventor of the geodesic dome; and the designer of the Ford Motor Company Rotunda Dome, Dearborn, Michigan; Golden Dome, American Exhibit, Moscow, U.S.S.R., 1959; Climatron for Missouri Botanical Gardens, St. Louis, Missouri, 1960; and U.S. Pavilion at Expo 67, Montreal, Canada, 1967; among many others.

Anyone who has heard Bucky speak will testify to the dynamism, the creativity, the stimulus of his approach to the total environment in which we are all involved. To experience contact with him is to experience a shot of adrenalin, the challenge of Everest, a walk in space. It makes us all aware of the unanswered problems, and of our latent potential as thinking, creating beings ultimately to solve these problems.

The Building Research Institute is proud and honored to welcome R. Buckminster Fuller as its first Fellow, and as an honorary Lifetime Member.

John Hancock Center Cited by NSPE

The John Hancock Center in Chicago has been selected by the National Society of Professional Engineers as one of the top ten engineering accomplishments of 1967.

Designed by BRI member firm Skidmore, Owings & Merrill, the Center, 100 stories and 1,100 feet high, was selected both for its unique tapered framework that is likely to find application in future tall buildings, and for the benefits of its multi-use approach. Combining apartments, offices, shops, and parking in a building that occupies only 40 per cent of its lot, it will give 24-hour land use, provide pedestrian space, and not increase the already dense population ratio of the neighborhood.

Other engineering projects singled out by NSPE include the San Francisco Bay Area Rapid Transit System, the launching of the Apollo IV spacecraft powered by the Saturn V rocket, the undersea cable plow developed to bury the shore end sections of the trans-Atlantic telephone cable, and the San Mateo Creek Bridge across San Francisco Bay.

Other projects recognized were Lockheed's aircraft hangar in Marietta, Ga.; the Dallas-Fort Worth Regional Airport; the further development of techniques for using nuclear explosives in blasting; the Toledo Bend Dam and Reservoir; and the demonstration that a complex-TWX-Data Phone combination can be used on a time-sharing basis by smaller engineering firms.

NSPE also commented favorably on engineering's contribution to bio-engineering, air pollution abatement, and water pollution control.

Institute Gains Nine New Members

Two professional firms, one company, and six individuals have recently joined the Building Research Institute.

The professional firms joining BRI are The Architectural Affiliation of Towson, Maryland, and Thomas A. Hanson Associates of Richmond, Virginia. Becoming a company member is Gulf American Corporation of Miami, Florida.

New individual members of the Institute are James M. Anderegg, President, Architects' Library Service, Inc., Detroit, Michigan; Ira J. Bach, Executive Director, Chicago Dwellings Association, Chicago, Illinois; Gerald Davis, Managing Director, Building Program Associates, San Francisco, California; Louis Michael, Louis Michael Realty Company, Toledo, Ohio; and Harry M. Riegelman, Vice President, Ador/Hilite, Subsidiary of Rusco Industries, Inc., Fullerton, California.

In addition, Reed A. Kiefer of Rome, Italy, has joined BRI as an individual member in the international category.

BRI CALENDAR

March 27-28—BRI Special Conference on Totally Manufactured Building Modules: The Case for Instant Space, Conrad Hilton Hotel, Chicago, Illinois.

April 22—BRI Board of Directors Meeting, Mayflower Hotel, Washington, D. C.

April 23-25—BRI 1968 Spring Conferences, Mayflower Hotel, Washington, D. C.

June 4-5—BRI Special Conference on Housing the Developing Nations, Hotel America, Washington, D. C.

Other Technical Meetings

March 15-17—Instrument Society of America, *18th National Conference on Instrumentation for the Iron and Steel Industry*, Pittsburgh, Pennsylvania.

March 18-21—Institute of Electrical and Electronics Engineers, *International Convention*, New York, New York.

March 18-22—National Association of Corrosion Engineers, *24th Annual Conference*, Cleveland, Ohio.

March 19-20—University of Delaware, *Construction Engineering Conference*, Newark, Delaware.

March 25-27—Edison Electric Institute, *Marketing Conference*, Sherman House, Chicago, Illinois.

March 31-April 4—American Institute of Chemical Engineers, *Materials Engineering and Sciences Conference*, Philadelphia, Pennsylvania.

March 31-April 5—American Chemical Society, *155th National Meeting*, San Francisco, California.

April 1-4—American Society of Mechanical Engineers, *Fourth Thermophysical Properties Symposium*, College Park, Maryland.

April 3-5—American Society of Mechanical Engineers, *Metals Engineering Conference*, New York, New York.

April 8-9—American Society for Testing and Materials, *Committee C-18 on Natural Building Stones*, Department of the Interior Building, Washington, D. C.

April 18-19—American Society for Testing and Materials, *Committee F-3 on Gaskets*, Dearborn Inn, Dearborn, Michigan.

April 20-25—American Ceramic Society, *70th Annual Meeting*, Chicago, Illinois.

April 21-24—National Association of Architectural Metal Manufacturers, *First Annual Trade Show and 30th Annual Convention*, Shoreham Hotel, Washington, D. C.

April 22-24—Association of Iron and Steel Engineers, *Spring Conference*, Pittsburgh, Pennsylvania.

April 25—American Society for Testing and Materials, *Committee E-1 on Methods of Testing*, ASTM Headquarters, Philadelphia, Pennsylvania.

April 29-May 1—Institute of Environmental Sciences, *14th Annual Meeting*, Chase Park Plaza, St. Louis, Missouri.

April 29-May 1—American Society of Mechanical Engineers, *Maintenance and Plant Engineering Conference*, Kansas City, Missouri.

May 5-8—American Institute of Chemical Engineers, *65th National Meeting*, Tampa, Florida.

May 5-8—American Society of Mechanical Engineers, *Incinerator Conference*, New York, New York.

May 5-10—Society of Plastics Engineers, *26th Annual Technical Conference*, New York, New York.

May 6-8—Industrial Research Institute, *Spring Meeting*, Boca Raton, Florida.

May 7-9—Purdue Industrial Waste Conference, Purdue University, Lafayette, Indiana.

May 12-16—Technical Association of the Pulp and Paper Industry, *19th Coating Conference*, Miami Beach, Florida.

May 13-17—American Society of Civil Engineers, *Environmental Engineering Conference*, Hotel Patten and the Read House, Chattanooga, Tennessee.

May 20-24—National Fire Protection Association, *72nd Annual Meeting*, Marriott Motor Hotel, Atlanta, Georgia.

May 20-24—Inter-American Conference on Materials Technology, San Antonio, Texas.

May 22-25—Acoustical Society of America, *70th Annual Spring Meeting*, Ottawa, Ontario. □

Statement by Gershon Meckler, President, Building Research Institute

A YEAR-LONG DIALOGUE within the Institute, which is comprised of individuals and organizations from every facet of the building industry, has brought into focus the importance and the value of our unique ability to develop a broad *inter-disciplinary* approach to research and innovation. Effective communication between the various factors of the industry is extremely important. It is in this area that BRI can serve to maximum advantage.

By functioning as a sophisticated, comprehensive, and central research and development group, interrelating the various technological disciplines, the entire membership will gain a more realistic understanding of the basic problems that face the building construction industry. This should serve as a direct approach to the successful innovation of methods and materials to help solve these problems.

Genuine innovations do not come as a result of conventional market research or questionnaires to customers. Their development requires insight into real needs of which customers are often not aware. Imagination is needed to see in a new discovery or idea the potentials of development into a new product or technique which the public will demand as soon as it learns about it.

Manufacturers of building materials and equipment cannot create new products in a vacuum. Their scientists and engineers are not fully cognizant of the building industry's problems or aspirations. If manufacturers want to overcome the "bugs" in new materials, and if they want to create new products to remain in the forefront of a developing industry, they must work more closely with all of the various facets of the industry. BRI is uniquely qualified to serve as liaison between the building profession and the manufacturer.

Examples of Areas Requiring Attention

1. Systematic studies of experience with buildings from a structural and functional point of view. Usually the only attention given a building after construction results from ad hoc problems and complaints, and then only for the purpose of correcting the immediate problem. The intention should be to gain knowledge and to document information which would be helpful in building future buildings. A coordinated effort is needed which would study experience with different kinds of buildings periodically over their lifetime, conduct prototype tests on actual structures during and long after construction, and study methods of relating quality and performance to user satisfaction and public acceptance.
2. The rationalization of the building industry to the end of complete cooperation between all of its members. This would include the participation in the industry by some elements not presently involved and the expansion of the involvement of others who are presently participating to a minor extent. It would also require the elimination or modification of some very strongly rooted customs, ethics and practices.
3. An integrated approach to, and large-scale research on, internal environment of buildings, covering relationships between latitude of a building, solar energy, fenestration area, glare, internal lighting

level, heating, ventilating, air conditioning, color and surface treatment, space allocation and physiological and psychological reactions of occupants. All of these factors are highly interdependent and have been attacked only piecemeal and unrelatedly, if at all. Because of the diverse character of the problem, the complex nature of the building industry, narrow proprietary interests, and the lack of apparent economic justification, such broad research has not been, and is not likely to be, undertaken or financed by any single segment of the industry.

4. A broad research effort aimed at applying modern systems analysis techniques specifically to construction situations, and the dissemination of such information widely and directly to, and in cooperation with, the construction industry, especially building contractors. Analytical techniques, based on modern mathematics and systems analysis, are available now and are being rapidly expanded and improved, yet the construction industry has responded only slowly and in isolated instances to the possibilities and benefits inherent in such techniques. Contractors, particularly, are in desperate need of an analytical quantitative basis for decision making that will direct the manager to some "best" solution or some set of alternatives from which an experienced judgment can be made. This lack has been brought into sharp focus by the increasing pace and complexity of the technological and competitive demands bearing on the industry.

Cost Reduction Through Innovation

A major result of innovation in materials and techniques is the reduction of building costs. In the face of an inexorable, year-by-year rise in the cost of building, the Building Research Institute believes that one of its chief responsibilities is to focus attention on research which shows a potential for slowing and possibly reversing the cost trend.

Board of Directors Restate Course

At the Annual Meeting of the Board of Directors on November 13, 1967, a program was developed to reflect the unification of interest of the BRI membership. Based on the information submitted by a large response of the membership to a recent survey, a dynamic course of action was adopted.

I. *Establishment of new technical orientation and programming procedures.*
   a. To further strengthen the role and importance of the technical committees by expanding their functions to include in-depth definitions of problems facing the building industry, thereby identifying opportunities for innovations in the building industry. In this effort, we shall ask the following questions about technical innovation in our industry:
      Where has significant innovation come from?
      How has it come about?
      What have been the problems involved, the obstacles?
      What are the possible directions of change?
      We are uniquely qualified to perform in this area through our technical committees because of the wide diversity of knowledge within our organization.
   b. To establish a working liaison with other technical organizations in our fields of interest.
   c. To concentrate our efforts into one major annual conference and to develop a series of regional technical conferences in-depth on specific subjects of topical interest to include the use of exhibits, the character of which will vary depending upon its appropriateness.

II. *Establishment of a membership advisory committee.*
   a. To expand the membership base and to encourage building technology student associate membership, as well as to review methods by which special member groups can be accommodated.

III. *Establishment of the BRI Press.*
   a. Whose function is to: Publish the BRI Journal on a quarterly basis; publish the technical papers of the BRI conferences; publish individual or company technical papers and treatises; publish important studies or reports of interest to the membership.

IV. *Establishment of the BRI Awards and Honors Forum.*
   a. To acknowledge special achievements in behalf of BRI and the building industry, such as the award of special fellowships, and special awards to individuals and organizations.

We plan to strengthen the staff by use of special services agencies and consultants. And, of major importance, we have established a BRI Endowment Fund, which has already been initiated by substantial contributions of the membership. This will be a vital factor in providing the flexibility which is so important to the effectiveness of the Institute.

The stated objective of BRI is to "encourage and support research and development throughout the industry and aid in the communication of ideas through the collection, correlation, documentation, and dissemination of building science information." This basic objective, on which BRI was founded sixteen years ago, is even more valid today than it was in 1952. Our industry is at a point in time when we must rationally interrelate the various technological disciplines to assure future growth and progress.

Through our organization, we are geared to address ourselves to the challenging problems and requirements of our industry. I solicit your individual contribution to this program, knowing our united effort will build a strong, viable BRI.

Editor's Comment

THE BUILDING RESEARCH INSTITUTE, as everyone else, is embarked on a new year. Many social and technological problems face our society and the world. They will not be solved this year. They will never be solved without effort, without communication, without cooperation, without an all-out massive attack.

The building industry needs plain talk. Nothing esoteric, nothing flamboyant. Just plain talk. It also needs action, more than we have ever had.

We suggest that you read President Meckler's statement and make up your minds to do something—anything—about the problems raised, *as long as what you do has a purpose, a direction, an ultimate goal of catching up to, and getting ahead of, the problems of a world faced with the greatest potential for both disaster and humanitarian action in its history.*

BRI intends to be an active force in the solution of these problems. When the time comes to stand up and be counted, we want to be able to say, "We were there."

The Building Science News pages of this issue show that BRI will, in fact, be there. We are presenting programs on instant space, innovations in building construction, office buildings, handicapped persons, sealants, floor-ceiling systems, housing for developing nations, and air rights. From concepts to nuts and bolts.

The building industry is too big, too complex, and too diversified ever to agree 100 percent on anything. But it can agree on the need for a frontal assault, by all its segments, on the multitude of technological, sociological, economic and purely human problems facing the peoples of the world.

Do you want to tackle this alone? Or do you want to pool your resources? In the long run, you, and those close to you, are the beneficiaries.

The Building Research Institute has no intention of taking on these problems alone. We cannot. No organization can. But the building industry of the United States, and its counterparts in the nations of the world, present the greatest potential for positive action ever seen in history.

The possibilities are staggering.

As the staff head of an organization representing but a small part of the greatest industry in the world, I propose—I challenge the builders of the world—that for two weeks in the summer of 1969 we meet somewhere—anywhere—to coordinate all of our resources and bring them to bear in a massive attack on all of our mutual building, environmental, technological and social problems.

This can be done. It will be done. Someday. Why not now? Delay will only multiply the task.

I ask all peoples, all countries, all organizations, all humans who have a spark of response to the greatest challenge in human history, to let me know their thoughts.

Forget all irrational, false, artificial barriers between peoples. All of us everywhere need help. We can be better off than we are.

Let us meet. Let us talk. Let us plan. Let us share our knowledge. And then let us work. Together.

We shall—we must—have a *World Building Conference on Human Problems.*

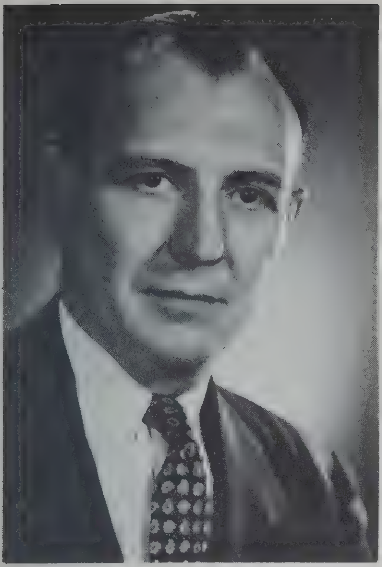
Let us have it in the summer of 1969. If you agree—if you disagree—if you will help—if you will contribute—write to me at Building Research Institute, 1424 - 16th Street, N.W., Washington, D. C. 20036.

Robert P. Darlington

Robert P. Darlington
Executive Vice President (Acting)

BRI Officers, Executive Committee, New Board Members

Gershon Meckler, President of the Institute and Chairman of the Executive Committee, is Vice President of Environmental Systems Corporation, Conyers, Georgia, a subsidiary of Lithonia Lighting, Inc. He is also a member of the Board of Directors of Rusco Industries, Inc., of Los Angeles. He was formerly a consulting engineer and general partner in the firm of Meckler-Hoertz and Associates, Engineers and Architects, Toledo, Ohio. A graduate of Pennsylvania State University with a B.S. in Engineering Physics, Mr. Meckler is a registered Professional Engineer in several states and holds a Certificate of Qualification from the National Council of State Boards of Engineering Examiners. Mr. Meckler is a member of the Illuminating Engineering Society and is Chairman of the Joint IES-American Society of Heating, Refrigerating and Air-Conditioning Engineers Committee on Light and Heat. A member of ASHRAE, he is Chairman of T.C. 2.6, Energy Requirements; a member of T.C. 6.2, Large Building Systems; and is an appointee to the Presidential Task Force to Study Energy Requirements for Buildings. He is also a member of the American Physical Society and of the National Society of Professional Engineers. He has worked extensively in research and development of energy-integrated environmental systems, and holds several patents in the fields of lighting, heating, and air conditioning.

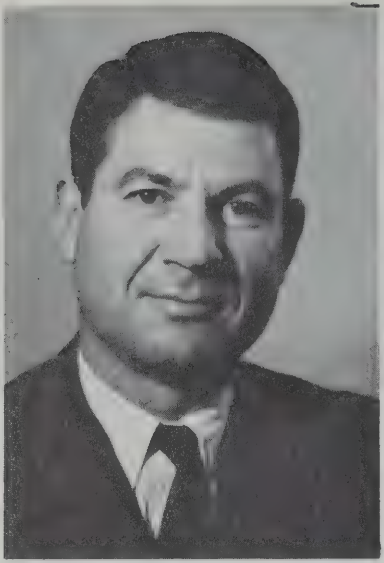


Dan E. Morgenroth, Vice President of the Institute and Vice Chairman of the Executive Committee, is Manager of Technical Sales, Home Building Products Division, Owens-Corning Fiberglas Corporation, Toledo, Ohio. Prior to assuming his present position, he was Sales Manager of the General Construction Materials Division, Manager of the Industrial and Commercial Construction Materials Product Development Laboratories, and Manager of the Corporate Testing Division, all with Owens-Corning Fiberglas. Mr. Morgenroth holds a degree in Civil Engineering from Purdue University, an A.B. from Shurtleff College, and a certificate in Naval Architecture from the United States Naval Academy. He is a member of the National Society of Professional Engineers; the American Society of Heating, Refrigerating and Air-Conditioning Engineers; the American Society for Testing and Materials; and the Toledo Engineering Society. He is also Vice Chairman of the BRI Technical Coordinating Committee and Chairman of Technical Division IV, Building Systems.

Ben H. Evans, AIA, Vice President of the Institute and a member of the Executive Committee, is Director, Education and Research Programs, The American Institute of Architects, Washington, D. C. Prior to joining AIA as Director of Research Programs, he was Head of the Architectural Research Program and Associate Professor of Architecture at the A&M College of Texas. He was also Research Architect with the Texas Engineering Research Station. Mr. Evans' experience has included planning and consulting activities with more than 150 architectural, engineering, and industrial firms. Author of numerous publications, Mr. Evans received his B.Arch. and M.Arch. degrees from the A&M College of Texas. He is a member of the Washington Metropolitan Chapter of the AIA. He is also a member of the Association of Collegiate Schools of Architecture, and a member of that Association's Committee on Graduate Studies and Research; a member of the Building Research Advisory Board; and a member of the Technical Committee on Light and Vision of the Illuminating Engineering Society. Mr. Evans is Chairman of the Education Liaison Committee of the Building Research Institute, a member of the Technical Coordinating Committee, and Chairman of Technical Division I, Community Ecology.

Rudard A. Jones, AIA, is Treasurer of the Institute and a member of its Executive Committee. He is Research Professor of Architecture and Director, Small Homes Council-Building Research Council, University of Illinois, Urbana, Illinois. Mr. Jones received his B.S. and M.S. in Architectural Engineering from the University of Illinois. He has engaged in practice in various architectural offices, and has conducted a limited personal practice. He has also taught in the Department of Architecture and the Department of Applied Mechanics at Kansas State University. For two years he served as Group Leader of the University of Illinois/International Cooperation Administration Housing Advisory Mission to the Government of Colombia, and he has been housing consultant in Chile under the auspices of ICA. Author of a number of publications, Mr. Jones is President of the Central Illinois Chapter of the American Institute of Architects; Secretary of Committee E-6, Methods of Testing Building Constructions, of the American Society for Testing and Materials; and a member of the Technical Studies Advisory Committee of the Building Research Advisory Board. He is a member of BRI Technical Committee 3.2, Wood, under Technical Division III, Building Materials.

Executive Committee



Edward T. Schreiber, a Member-at-Large of the Executive Committee, is founder and President of Construction Consultants, Inc., Detroit, Michigan. Mr. Schreiber is active in the American Society for Testing and Materials; a Director and a past officer of the Construction Specifications Institute; and a member of the Editorial Advisory Board, Roofing Manual Project, American Institute of Architects. His technical papers have received extensive publication. Mr. Schreiber attended the University of Michigan and the University of Notre Dame. He is an At-Large Member of the BRI Technical Coordinating Committee; Chairman of Technical Committee 4.4, Roof-Ceiling Systems, under Technical Division IV, Building Systems; and a member of Technical Committee 6.3, Techniques, under Technical Division VI, Construction Administration.

Joseph A. Rorick, a Member-at-Large of the Executive Committee, is Director of Operations, Eastern Area, Real Estate and Construction Division, IBM Corporation, White Plains, New York. A graduate of Notre Dame with a B.S. in Mechanical Engineering, Mr. Rorick is a Licensed Professional Engineer in New York State. He is an At-Large member of the BRI Technical Coordinating Committee.

Stewart D. Barradale, a new member of the BRI Board of Directors elected to a three-year term, is Manager of the Construction Research Department, Research Division, Weyerhaeuser Company, Seattle, Washington. Before joining Weyerhaeuser Mr. Barradale was Manager of the Building Research Station, Southwest Research Institute; Program Leader in the Building Research Laboratories, Princeton, New Jersey; and Program Supervisor, Architectural Design and Housing Research Department, John B. Pierce Foundation. A graduate of Rensselaer Polytechnic Institute with the degrees of B.Arch. and M. Arch., Mr. Barradale is a Registered Architect in New York State.

New Board Members

Harold C. Bernhard, newly elected to the Board of Directors for a three-year term, is a Senior Partner in the architectural firm of Shreve, Lamb & Harmon Associates in New York City. A member of that organization for more than 30 years, he was Associate and Partner before becoming Senior Partner in the firm. Mr. Bernhard received his B.Arch. and M.Arch. from Cornell University. He is a member of The American Institute of Architects, Architectural League of New York, Construction Specifications Institute, and the Guild for Religious Architecture.

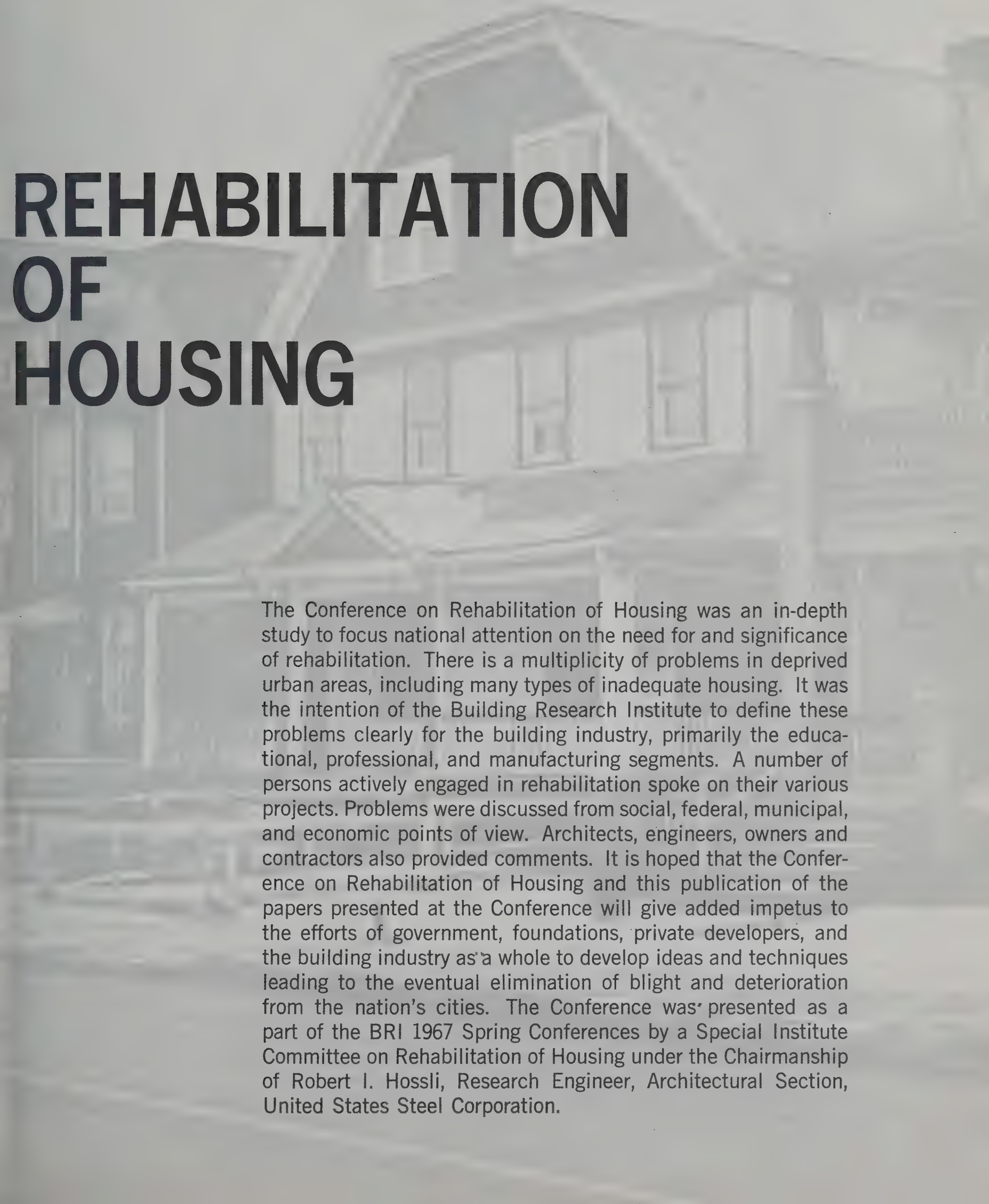
Frank A. Biberstein, a new member of the Board serving a three-year term, is Professor and Head of the Department of Civil Engineering at The Catholic University of America in Washington, D. C. He has been a member of the faculty there for more than 40 years, and he has also engaged in extensive consulting work. Author of numerous publications, Mr. Biberstein received his B.S., M.A., and C.E. degrees from Catholic University. He is a Fellow of the American Association for the Advancement of Science; a Fellow of the Washington Academy of Sciences; Consultant to the Building Research Advisory Board; Chairman, Engineering Education Committee, National Capital Section, American Society of Civil Engineers; and Chairman of Technical Committee C-15 of the American Society for Testing and Materials. He is a Councillor, Middle Atlantic Region, for ASTM. Mr. Biberstein is Catholic University's Institutional Representative to the Engineering College Research Council of the American Society for Engineering Education. He is a Registered Professional Engineer in Maryland and Virginia.

Robert F. Hastings, FAIA, has been elected to a three-year term on the Board. President of the Detroit architectural and engineering firm of Smith, Hinchman & Grylls Associates, Inc., Mr. Hastings attended the University of Wisconsin and the University of Illinois. He holds a degree of Bachelor of Science in Architectural Engineering from the University of Illinois and an honorary degree of Doctor of Architecture from Lawrence Institute of Technology. He is a registered architect and registered engineer in a number of states. Mr. Hastings is Vice President, Chairman of the Council of Commissioners, member of the Executive Committee and Board of Directors, and former Treasurer of The American Institute of Architects. He is a member of the Architects Advisory Council of the Porcelain Enamel Institute; Trustee of Producers' Council Educational Foundation; Chairman of the Professional Activities Board of the Engineering Society of Detroit; member of the Long Range Planning Committee of the Michigan Society of Professional Engineers; Chairman of the Education and Registration Committee of the Michigan Society of Architects; and member of the National Society of Professional Engineers and the American Society of Civil Engineers. He is a member of the Selection Committee to the Pittsburgh Plate Glass Foundation.

Robert A. LaCosse is serving a two-year term as a member of the Board of Directors. He is Technical Director of the Insulation Board Institute, Chicago, Illinois. Before joining that Institute he was structural engineer with the National Forest Products Association. Mr. LaCosse is a graduate of Chicago Technical College with Bachelor's degrees in Engineering Construction and Building Construction. He is a member of the American Society for Testing and Materials; the American Society of Heating, Refrigerating and Air-Conditioning Engineers; the Forest Products Research Society; and the Technical Association of the Pulp and Paper Industry. He is Membership Secretary for ASTM Committee D-7 on Wood; Secretary of Subcommittee IV on Application of ASTM Committee C-20 on Acoustical Materials, and ASTM Committee C-16 on Thermal Insulating Materials; and Liaison Member to Committee D-7 and TAPPI. He is also a member of the Structural Fibrous Materials Committee of TAPPI. Mr. LaCosse is a member of BRI Technical Committee 4.4, Roof-Ceiling Systems, under Technical Division IV, Building Systems.

Joseph H. Newman has been elected to serve a three-year term on the Board. He is Vice President of the Tishman Research Corporation, a subsidiary of Tishman Realty and Construction Corporation, Inc., New York. Before joining Tishman Research, he was with the Flintkote Company and Curtiss-Wright. Mr. Newman received his Bachelor and Master of Chemical Engineering from the Polytechnic Institute of Brooklyn. Mr. Newman is a member of the Building Research Advisory Board and Chairman of its Standing Committee on Urbanization and Rehabilitation. He is also on the Advisory Panel to the Building Research Section of the National Bureau of Standards. He is a member of BRI Technical Committee 4.6, Partition Systems/Doors, under Technical Division IV, Building Systems.

William F. Reardon has been named to the Board for a one-year term. He is Manager-Engineering, Real Estate and Construction Operation, General Electric Company, Schenectady, New York. He had previously been Estimator, Staff Engineer, and Manager of Construction with the organization. Before joining the General Electric Company, he served in design and construction of manufacturing facilities with the firm of A. J. Daniels, Engineers and Constructors, and he was in the design department of the Tennessee Valley Authority. Mr. Reardon graduated from Worcester Polytechnic Institute with a Bachelor of Science degree in Civil Engineering. He engaged in advanced study at the University of Tennessee. He has served as Chairman of BRI Technical Division VII, Building Management.



REHABILITATION OF HOUSING

The Conference on Rehabilitation of Housing was an in-depth study to focus national attention on the need for and significance of rehabilitation. There is a multiplicity of problems in deprived urban areas, including many types of inadequate housing. It was the intention of the Building Research Institute to define these problems clearly for the building industry, primarily the educational, professional, and manufacturing segments. A number of persons actively engaged in rehabilitation spoke on their various projects. Problems were discussed from social, federal, municipal, and economic points of view. Architects, engineers, owners and contractors also provided comments. It is hoped that the Conference on Rehabilitation of Housing and this publication of the papers presented at the Conference will give added impetus to the efforts of government, foundations, private developers, and the building industry as a whole to develop ideas and techniques leading to the eventual elimination of blight and deterioration from the nation's cities. The Conference was presented as a part of the BRI 1967 Spring Conferences by a Special Institute Committee on Rehabilitation of Housing under the Chairmanship of Robert I. Hossli, Research Engineer, Architectural Section, United States Steel Corporation.

The Need for Massive Rehabilitation

ALL OVER THE UNITED STATES, government agencies, social welfare and social action groups, and more recently, financial, manufacturing and construction circles, are turning from clearance to rehabilitation of dwellings and neighborhoods for the following reasons:

1. It may retain the social values of viable, or potentially viable neighborhoods.
2. It can minimize or eliminate relocation problems.
3. Construction can be less expensive and faster than new housing.
4. It can open new opportunities for investment.

Scope of Existing Programs

This nationwide interest has produced a variety of proposals, and some small scale programs included under the undefined rehabilitation umbrella. Rehabilitation is often used to describe stepped-up code enforcement activities, or information programs for home owners and tenants, variously labelled "home management," "tenant education," or "self-help" proposals.

Other concepts view rehabilitation at higher levels. In a few cities, New York, Philadelphia, Chicago and Pittsburgh, notably, non-profit and limited-profit groups have been organizing to acquire single and multi-family structures and rehabilitate them in depth with the assistance of federal mortgage insurance. In New York City, rehabilitation experiments have combined HUD and OEO assistance, non-profit front money, below market loans, rent assistance, expert personnel and new technological systems in extremely sophisticated rehabilitation designs.

Until very recently, rehabilitation programs were, in the main, developed on a small scale basis. Prior to 1966, the rehabilitation program of Pittsburgh Action called for early activity affecting 22 dwellings. In New York, where there are 276,000 substandard units, current rehabilitation activity of all kinds (exclusive of code enforcement) will affect less than 5,000 low rent dwellings.

However, within the last eighteen months, a nationwide, almost explosive interest in rehabilitation has developed. Philadelphia is talking about fixing up

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HORTENSE W. GABEL, Consultant, Department of Housing and Urban Development.

5,000 dwelling units on a turnkey basis. Massive action is planned for Pittsburgh. The U.S. Gypsum Company is expanding its operations into at least five cities. Industrial trade associations, systems companies, and other private groups are taking a new look at the older sections of our cities. They see an absolute necessity for the revival of these communities. They also see a profit role for private enterprise.

Problems in Mounting a Massive Rehabilitation Program

We have long been familiar with the social problems that are endemic to slums. But there are other major problems which we have only recently begun to identify. These are the high cost of land and buildings; the high cost of money; lack of development funds to cover preliminary legal, technical and organization expense, and preliminary acquisition costs; the cost of taxes; antiquated technology; poorly trained and inadequate personnel in and out of government; the failure to understand the links between standard dwellings and education, transportation, sanitation, sewage disposal and other required services; and lack of information and access to expert counseling.

These problems are interrelated. When cities fail to solve them, they produce exploitative shelter costs for the poor in an inadequate physical and social environment. This inefficient and inhumane environment is maintained by the municipality at exorbitant capital, as well as operating, costs. All of these constraints must be taken into consideration if our existing neighborhoods are to be upgraded.

Some of them are of particular importance.

Antiquated technology. Systems analyses and engineering of construction and reconstruction processes are non-existent. Research by construction companies is restricted mainly to rather crude experiments in materials handling and installation methodology. Local building trade unions have a vested interest in compelling the use of obsolete materials and systems. Materials producers spend a great deal in the development of their individual products, but virtually nothing in trying to develop improved systems, and nothing at all in efforts to improve the interrelationship of a particular company's products with those of other firms. Industrial efforts to establish cooperative research and development programs have had limited success.

Research by the design professions has been mainly in the area of space planning. Data on materials flow to the designer primarily from catalogs supplied by the materials industry. Data on costs and construction methods are mainly composed of rather sketchy information on past performance of contractors.

Though there are strong indications that this may change, Federal government research is limited by pressures from Congress, labor and materials supply groups. Local government activity is confined largely to land use and traffic studies.

Sewage and refuse disposal systems, which have a vast impact on the quality of neighborhoods, with the exception of the questionable improvement of incineration, have not progressed in appreciable degree for the last hundred years.

And yet, massive investments of research funds are not necessarily the only spur to far-reaching improvement of these systems. Thus, an ingenious mind, together with effective presentation of the market potential, has produced a prefabricated kitchen and bathroom unit within a few short months, which is being installed in New York City's Fifth Street Rehabilitation Project.

Inadequate personnel in and out of government. The lack of government expertise is critical. Most middle level federal and local government personnel have limited understanding of the components of a rehabilitation program. They are confused and dilatory in decision making, and often unable to communicate decisions effectively when made. This is compounded by most housing agencies' general view of themselves as reviewing rather than servicing mechanisms. Schools of law, architecture, planning and business fail to teach appropriate courses.

Until recently, most major contractors, operating in the horse and buggy school of trial and error, were afraid of rehabilitation. In New York City, the 114th Street project was undertaken with great hesitancy by a well established general contractor, and only because of a strong sense of social commitment by one of the firm's members. To the company's surprise, it will earn a real profit on the job. The need for involving indigenous residents, community groups and local contractors and sub-contractors has only begun to be explored. Training these local groups, often of minority extraction, will be difficult, but not impossible, and is absolutely necessary.

Obsolete real estate management practices. Management of older, smaller structures is at a primitive level. Because of this, responsible real estate firms hesitate to undertake these jobs. Local management groups frequently do as much to run buildings down as they do to collect rents. The European concierge system, cooperative tenant management plans, janitor training programs and many other devices and organizations must be explored and tested.

There is a total need to train and retrain all segments of the rehabilitation complex to use efficiently our present tools and emerging improvements.

The potential. The challenge which faces public and private enterprise is the rehabilitation of the totality of urban slum neighborhoods in which five million households reside. Basically, these neighborhoods are anomalies which require rationalization. The need is for programs to rebuild the physical structure of the communities, while their socio-economic viability is maintained and enhanced.

For this purpose, the dwelling, the multi-family structure, the neighborhood itself, must be viewed as an aggregate of systems designed to satisfy the physical and social needs and desires of the residents. The range is from toilets to community facilities, from privacy to group activities affecting the entire community. Some of the systems we are concerned with are physical.

1. The layout, design and prospects for modification with changing needs.

2. Walls, floors, ceilings, windows: their materials and their maintenance; their first cost and their total cost.

3. Heat, light, ventilation, water and sewage systems.

4. Horizontal and vertical access to structures and units within structures, including traffic, streets, stairs, elevators, escalators, etc.

5. Fireproofing of new components and existing structures.

6. Bathrooms and kitchens.

7. Security.

Some relate to organization of the neighborhood, the provision of community facilities and programs, and the utilization of outdoor space, on the streets, the backyards, the roofs and in parks.

The public and private sectors, working together, must be concerned with materials and methods of installation, and the management and maintenance of each system. More important, we must be concerned with systems for the fastest and most economical methods of integrating these installations and the management of these systems in their totality, always for the benefit of and with the involvement of the residents. These systems must also be designed so that the luxuries of today can be added at some modest cost in the future, as today's luxuries become tomorrow's necessities.

Rehabilitation, new construction or both? Different financial, physical, political and sociological conditions which must be identified, will dictate the choice of rehabilitation, the construction of new housing, or a combination of both. In one community, rehabilitation and conservation of existing structures may be the most effective choice. For others, where there is an absolute necessity to reduce density, or where structures are beyond repair, demolition may be required. In others, optimum values may be achieved through a combination of rehabilitation and new housing. Some neighborhoods may be most effectively maintained through platforming new construction over existing dwellings or through construction in the alleys or roadways.

Next Steps

1. Training the necessary skills, including architects, engineers, government officials, lending institutions, managers, contractors, subcontractors, craftsmen. Training programs must reach beyond the conventional devices of conference, seminar class room and apprenticeship. They might well include experimental devices such as:

a. Senior internships to permit senior practitioners to spend periods of six weeks to three months in New York, Washington and other centers of rehabilitation activity.

b. Payment of overcosts for training of indigenous contractors, real estate and management personnel, and other segments of the industry through short term association with major concerns.

Training programs must be sensitive to, and seek to overcome, misinformation and fears, often psychological, which have inhibited public and private investment in deprived areas.

We must train for skillful application of existing programs, at the same time that research, demonstration and development will render these programs obsolete. The balance between short and long term is critical.

2. Public and private information and counselling services to bring the latest developments to the attention of the general and special publics must be established. Counseling staff should advise interested groups on problems such as:

a. Land and property assembly.

b. Architectural planning and cost analysis.

c. Negotiations leading to a construction contract or contracts.

d. Negotiations with lending institutions, the F.H.A. and local government agencies.

e. Relationships with residents and concerned community organizations.

f. Property management before, during and after construction.

g. Development and administration of corollary social services and action programs.

3. The necessity for effective research and development is paramount. Government, industry and the universities must work cooperatively to redesign, reconstruct and redevelop new systems in the laboratories of universities, of the building industry, in housing and environmental agencies and in other fields where technology may relate and be applicable to the rebuilding of houses and neighborhoods.

Experimental programs in typical localities through demonstration of actual reconstruction must be developed through:

a. Organizations of private consortiums to take advantage of the capital investment opportunities which are only beginning to be perceived by the private market.

b. Organization of non-profit and limited profit companies on national, regional and local bases. Successful demonstrations could be transferred, after completion, to government as public housing or to the private sector, with FHA financing.

Development funds should be used to provide working capital advances to competent but under-capitalized building firms and sub-contractors. This could broaden opportunities and strengthen the capacity of many small and minority owned firms. In large cities particularly, this has become a real need for hundreds of small businessmen, who at present cannot obtain performance bonds, or take advantage of large scale purchasing. ☐

Mrs. Gabel has been Rent and Rehabilitation Administrator for New York City and Assistant to the Mayor for Housing in New York. She holds an A.B. from Hunter College and an L.L.B. from the Columbia University Law School.

Social Aspects of Rehabilitation

REHABILITATION OF SLUM PROPERTIES must be viewed in terms of what is contributed to the solution of the problems of our city, the ghetto, and segregation.

Rehabilitation, a very loosely-defined term, is not an end in itself but one of the options available to us whose potential has not yet been fully determined.

What we are attempting to do in demonstration programs in selected areas of New York City stands squarely at the center of all the questions currently being asked about the future of our cities.

First, there is the ghetto. We know that the ghettos are no longer way-stations for immigrants en route to better things, to full participation in the America of their dreams. We know that because of the peculiarity of American racial attitudes and practices, the ghettos are no longer open-ended, they are ethnic dead ends, in which, in the case of New York City, Negroes and Puerto Ricans are, to all intents and purposes, confined. We know that the ethnic ghettos are becoming an increasing danger, that there has been violence and that all forecasts made by responsible observers indicate that there will be more violence. In short, there is more work to be done.

The root cause for the drive toward rehabilitation and new construction in slum areas is socially conditioned. This may be obvious but it is worth re-stating. Our experience in New York leads me to these conclusions:

The rehabilitation of buildings in urban areas for low-rent housing cannot be thought of merely or simply as an inexpensive or easy way to provide housing facilities. The overall reason for rehabilitation must be social. The lack of large scale urban renewal funds to create new housing; the desire to retain existing neighborhood values; the need to maintain past architectural scale and aesthetic values; the overall objective of minimizing relocation: all add up to a program in which rehabilitation necessarily must be a major component in the all-out war we must mount against the ghetto.

But we must disabuse ourselves of the notion that rehabilitation is a shortcut, or can be done inexpensively, or is appropriate to every area.

The cost of rehabilitation at a scale which does not require massive relocation will range anywhere from 75 to 100 percent of new semi-fireproof construction. These costs are based on total rehabilitation, including new heating, plumbing, wiring, stairs, windows, partitions, wall, ceiling and floor finishes; and patching, painting and miscellaneous work on exterior walls and roofs.

This extent of rehabilitation is usually required in highly deteriorated districts. However, it represents the cost of building rehabilitation only. It does not include any costs for new community and neighborhood facilities.

Neighborhood planning must precede the rehabilitation of individual structures. It must be at a scale sufficiently large to identify natural boundaries, e.g.,

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FRANK C. MONTERO, Associate Director, Community Improvement Corporation of Manhattan, New York, New York.

highways, changes in land use, and street patterns. It must also identify major problems and assets in such things as building conditions, traffic congestion, shopping patterns, overcrowding, community facilities and institutions, open space, and recreation, and must identify specific neighborhood characteristics so that rehabilitation can be applied in locations where it will do the most good.

The scope of rehabilitation, therefore, must be at a neighborhood scale, rather than on an individual building basis. It is imperative to rehabilitate the neighborhood as well as individual structures. Environmental problems usually grow out of the accumulation of deteriorating structures. After a certain point is reached the problem becomes environmental and neighborhood in scope and therefore requires environmental and neighborhood cures.

This is particularly true for rehabilitation since the "neighborhood" has a poor reputation to begin with. It is not sufficient merely to "fix up" a few buildings or even a few blocks. The entire neighborhood must be provided with adequate community facilities, new open spaces and recreation, solutions to traffic problems and other physical facilities as well as attractive sample housing accommodations in order to reach the objective.

If economic, social and racial justice are objectives of our society, then the physical improvements proposed for rehabilitation of an area, either at the neighborhood scale or for the individual apartment, must be of a sufficiently high quality that it is not only acceptable, but desirable, for all but the "luxury" group. The public housing program evolved in the thirties overlooked this important concept and stigmatized low-rent housing not only by institutionalizing it, but by identifying it with poor design and inferior facilities. It was, in fact, merely a more up-to-date ghetto.

In New York, we are involved in several rehabilitation projects, now in various stages. One is the well-known West 114th Street project, in a ghetto neighborhood of purest ray serene. Another is in Brooklyn, in the Park Slope section not far from Bedford-Stuyvesant, and will soon be in construction. The Park Slope section is what sociologists call a changing neighborhood, which in straight English means that Negroes and Puerto Ricans have moved in and everybody is nervous.

The two projects differ. It will serve our purposes to examine some of these differences in the light of what has previously been said.

West 114th Street Project

The West 114th Street project has perhaps been over-publicized in favor of the courageous and knightly redevelopers charging into one of the city's "worst blocks, a rat-infested hustler's street," and, with the magic of their benevolence and good-will and money, transforming these grim tenements into an oasis of civic virtue.

Would that it were that simple.

The block was a "bad" block. It was a typically bad block, no better or worse than thousands of other ghetto blocks. The houses were old-law tenements, originally built to house immigrants, and now in that typical state of frightful disrepair common to the ghetto. All the horror stories are true: there were rats and roaches, and garbage littering the streets and halls. There were narcotics addicts and their pushers, and winos.

When we took a look at the people who were actually living on the block, we found that there were many more dimensions to the picture. There can be no doubt that most of them were mired in the culture of poverty, victims of the vicious circle of ghetto life: inferior housing, education and employment opportunity. However, much of the pathology on the block did not come from the residents themselves. The winos and junkies often came from other blocks because they could loiter on West 114th Street in comparative peace. There were individual apartments which were as well maintained as any on Sutton Place and we found responsible individuals who were both willing and capable of working with us.

When we began construction, planning was very much in the forefront of our minds. We sought and received the advice and cooperation of a number of community organizations. The City Rent and Rehabilitation Administration set up and staffed an office on the block with funds from the Federal Office of Economic Opportunity.

We paid close attention to the racial composition of the work force which was contracted to do the actual work. We hired a construction company as a general contractor which has a reputation for leadership in race relations. Well over half the workers on the job at any given time were Negroes and this had an appreciable effect on morale. Many of the sub-contractors were Negro firms, and the moving man employed was a resident of the block.

It is a significant fact that three of the Negro sub-contractors on the project brought their entire shops into four different construction unions.

Social services were an integral part of planning. The long-range goal of these services is to increase as rapidly as possible the economic and social potential of the tenants so they will be able to occupy apartments without rent subsidies and other social assistance. This is, of course, the ideal, and our efforts have only begun to scratch the surface.

Part of this program was to begin providing the community services and resources which are taken for granted in middle-class neighborhoods but do not exist in the ghetto.

Therefore, we had to start building from the ground up. Non-resident narcotics and winos were pressured to leave, and residents teamed up to get rid of mountains of garbage and trash that had piled up in basements and backyards. A Block Association has been formed, and under it, other committees have proliferated. There is a Block Council within the Association to coordinate activity, a children's play group supervised by HARYOU-ACT aides, a Personal Service Committee which aids residents in time of hardship. There is now activity where there was once apathy.

As of the moment, the Urban League of Greater New York is planning to institute on West 114th Street a comprehensive set of social programs which could intervene in the usual pattern of the social pathology of the ghetto in New York. Through the use of the existing basement facilities on the block, a range of programs in a non-institutional setting will be available and easily accessible to the residents of West 114th Street and the surrounding area.

Although each segment of the total complex will have specific objectives, the basic objective of the total range of programs is to assist the residents of West 114th Street and adjacent areas to realize their own potential and function at the highest level of their respective abilities.

The proposed 114th Street social service program will operate on a small scale in the same way that the model cities programs are scheduled to operate—by assembling the resources of private and government agencies to mount an across-the-board attack on the problems of the urban poor.

Park Slope Project

In Brooklyn, in the Park Slope section which is adjacent to Prospect Park, we are dealing with different conditions.

The buildings themselves are brownstones, rather than old-law tenements, and it is important to note the differencees between them. The old-law tenement is approximately 70 to 80 feet deep, with interior air and light shafts. They are 5 to 6 stories high and occupy 75 to 80 percent of the lot. The brownstone is 40 to 50 feet deep, with all "living" rooms opened by windows and with front and rear open spaces. They are 3 to 4 stories high and occupy 45 to 55 percent of the lot. We have thus found that rehabilitated brownstones provide a more permanent and habitable living environment than the old-law tenements.

The second important fact about Park Slope is that it is still, unlike Harlem, a racially balanced community. Our program hopefully will preserve this socially desirable condition, preventing the spread of the ghetto.

One of the most recent and most positive developments in the rehabilitation picture is that a debate is beginning to emerge as to the advisability of non-profit groups participating in rehabilitation itself. This debate is significant because it is for the first time based on some experience rather than speculation.

On March 5th, the New York Times carried a story that a leading New York civic group has decided, after four years as the owner of two tenements on the Lower East Side, that it is virtually impossible for a landlord to maintain decent living conditions in a slum area and make a profit. This is of special concern because the group is the Citizens Housing and Planning Council, and its executive director and the spokesman who made the statement is the widely known and deservedly respected Roger Starr.

Mr. Starr states almost categorically that non-profit sponsors should not get into the rehabilitation business. His three stated objections are: that rehabilitation requires expert management that non-profit groups cannot provide; that vandalism increases the costs of maintenance to such an extent that profits are impossible; and that the sponsor, by his nature, lacks a long-term interest and tends to lose interest in the projects once the excitement of doing the work is over.

We beg to differ. We feel most strongly that it is essential for non-profit sponsors to stay in the housing field and, indeed, to increase their participation a millionfold. We also feel that it is hardly justified to use the experience gained in working with only 2 buildings to extract such major conclusions.

In the first place, expert management and profit are not necesarily directly connected. There is no reason why non-profit sponsors cannot hire expert management. The ability of a project to support expert management is really determined by its scale. One or two buildings simply cannot support a competent management setup. On the other hand, a larger scale project such as West 114th Street can and demonstrably does support effective management.

Effective management has a direct bearing on vandalism. Our experience definitely shows that vandalism can be minimized with adequate supervision by project staff. A necessary ingredient, which must be stimulated by social planning, is the active interest and participation of the residents themselves in maintaining their housing conditions.

This whole question of vandalism and deterioration in neighborhoods is a vexing point. Isn't it, after all, the essence of the ghetto? Isn't it what we are here to fight?

Deteriorating properties, not subject to vacancy loss in New York City's rent-controlled housing market, are not subject to normal levels of real estate profitability except by cut-backs in service. There is no economic need for the owners to maintain their properties, and the tenants, mired in the culture of the ghetto, lose control over their living standards.

Therefore, to Mr. Starr's blanket statement that non-profit organizations have no place in the housing field, we object strenuously.

There is a necessary place for the non-profit sponsor, both in rehabilitation and new construction. It would be tragic if non-profit sponsors just picked up their marbles, i.e., their seed money, and went home just because they didn't like the way the game was going.

Non-profit groups have the basic advantage of being able to operate with the flexibility and freedom sacred to the private entrepreneur. For instance, mutual insurance companies have been doing this in their field for years. Concerned for and responsible to their policy holders, they provide a non-profit service. Non-profit effort in the housing field can provide equally effective service for tenants on a long-term basis without the need for return on investment. Groups of non-profit organizations large enough to benefit from the savings inherent in large-scale operations and receiving the subsidies necessary for housing at low and moderate rent levels have the same potential in housing as the mutual companies in insurance.

A public commitment to provide decent housing for all citizens is the basic necessity. For families whose incomes are too low to pay rents in the unassisted housing market, there is an obvious need for subsidies if this commitment is to be honored and the public interest served. Through various combinations of low interest rates, land write downs, long-term mortgages, real estate tax abatement and rent supplements, non-profit groups can provide a substantial number of the units required. If it is argued that only public housing authorities should provide subsidized housing, then the government will eventually become landlord for more than one million families, leaving little basis for comparison of costs, quality or management; and, because of its legal and administrative requirements, it will perpetuate economic segregation.

In New York City alone, there are 135,000 families waiting to get into public housing. If rent-subsidized housing is left solely to government authorities, we are in danger of being placed back where we started in the thirties. If for no other reason than the desire to avoid this, we should encourage, rather than discourage, further experimentation by non-profit organizations willing to undertake the responsibility for developing and managing housing projects.

Recent amendments to the Federal housing legislation provide further stimulation to non-profit groups in the housing market. Even Mr. Starr affirms the fact that the city, state, and federal governments must provide high subsidies to both landlords and tenants if the slums are ever to be made habitable.

Perhaps the most creative and potentially fruitful approach in providing genuine help where it is really needed in housing is the rent subsidy program enacted in Congress in mid-1965. Under this program, families must have an income of not more than $4,300 a year to qualify for rent help. When families move into new buildings or rehabilitated buildings, they must pay out 25 percent of their income in rent, and the government pays the rest. If income rises enough so that 25 percent pays the full rent, the government subsidy ends.

This is good news for people undertaking non-profit housing because it places a financial cushion under the projects. It also removes the risk of eviction for low income and welfare tenants who work and earn growing incomes. This places the question of individual incentive, so basic to our national experience, in its proper perspective.

President Johnson calls the program "the most crucial new instrument in our effort to improve the American City."

Though it got off to a delayed start, the program is on the verge of rapid growth. It is a saddening development now, that just when it is getting off the ground, it has come under fire from Congressional conservatives and is in danger of being fatally emasculated.

Conservatives in Congress contend that the Vietnam war requires a retrenchment in domestic welfare spending.

There are other objections: "I don't know how you can justify taxing John Smith to pay Bill Jones' rent, or part of it," says Representative Charles Jonas of North Carolina, the ranking Republican on the House Committee that handles the rent supplement program's money. "Before long John Smith will want part of his rent subsidized, and the Administration will raise the income limits. It'll go on and on and on."

Representative Paul Fino, Republican of New York, accuses the Administration of wanting to subsidize "spongers and loafers" to the "discouragement of the guy who works." Mr. Fino contends that the Administration's motive is simply to mix poor people with middle-income families, and Negroes with whites.

On the other hand, the Citizen's Budget Commission of New York, hardly a hotbed of radical sentiment, said in a recent statement: "It is to be hoped that ways might be found to place greater reliance on rental subsidies, primarily in lieu of, but also in addition to, tax exemption. Rental subsidies probably represent the most flexible tool in reconciling the tenants' income with the true economic cost of shelter. If the process of economic and social integration is to be furthered in the field of housing, the more flexible the tools, the greater the chance of success."

To Mary Saunders of Cleveland, a 33-year-old mother of two, who lives in a 2-bedroom, rehabilitated apartment in Cleveland, Ohio's, Hough (rhymes with "tough") District, the program is a matter of life or death. The Wall Street Journal, on March 10th, called her "one of the most unusual people in the United States" in that she is benefiting from the rent subsidy program.

Mrs. Saunders' reaction is much simpler: "I just want good housing and schools for my kids."

There is also the question of human dignity. An old Negro spiritual says:

"The wall's too high, you can't get over it,
Too low, you can't get under it,
Too wide, you can't go 'round it,
You must come in at the gate."

Those of us who work on the street can only echo these sentiments and those of Mrs. Saunders.

First of all, there are the people. On West 114th Street, there are 1600 people. There is as much human variety to be found here as anywhere, and the picture was not one of unrelieved gloom. Once we began to work with the actual block residents, we began to see daylight.

Proof of the fact that human nature is flexible is the recent report that there has been a 15 percent decrease in the number of Negro narcotics addicts. This is a sign of the times; it is one indication that there are new winds of hope stirring in the slums. A striking example of the way a statistic can be brought to life is that at every meeting of block residents, strong determination to overcome the narcotics problem was one of the first things voiced.

Summation

Just as central to the success of a project as the quality of bricks and mortar is the need to fuse the construction process with basic social services to make maximum feasible participation of the residents a reality at every step of the way.

The day is gone when people's lives can be interfered with, no matter how well-motivated, and disposed of, without their participation and consent.

This leads finally to the question of ultimate ownership, to which no one has given serious attention. There are some who say that one of the social objectives should be to bring about local ownership with concomitant management and maintenance by trained resident-owners. It is felt that local ownership should be the end result of programs for raising the income and cultural level of the residents. The best method of devolving ownership will be found as increased responsibility develops, whether a cooperative corporation whose stockholders consist of apartment residents, through a lease option agreement leading to condominium ownership of individual apartments, or a neighborhood-based corporation, composed in part of residents, which would lease apartments.

Meanwhile, we must work to make such a state of affairs possible and take the first steps. West 114th Street has been a pioneering demonstration project. We are in the process of rehabilitating a neighborhood on the largest scale that has yet been done. We have made a beachhead in the ghetto. It is a small beachhead. It must be consolidated.

The spirit of the ghetto threatens.

We do not believe that the spirit of the ghetto cannot be exorcised or that these problems are insoluble. We do believe that our society has not given the attention and deployment of resources to the problem of the slums that its magnitude necessitates. We have tended to let our cities grow by themselves. As James Rouse, a builder with vision who intends to do something about our cities, says: "Nobody really believes in the American City: we have lived so long with old, worn out ugly places that we have become anesthetized to their condition. We are adding to our cities every month the equivalent of a new Denver, Dallas, and San Diego."

We believe along with Mr. Rouse that something can be done. We believe that planning is the most vital ingredient and this planning must be done with the best techniques and systems, with the latest instruments and procedures, that our society affords.

A revered New Yorker, Jacob Riis, the Danish immigrant and American reformer, writing in 1902 explained the process: "The slum is as old as civilization. Civilization implies a race to get ahead. In a race there are usually some who, for one cause or another, cannot keep up, or are thrust out from among their fellows. They fall behind, and when they have been left in the rear they lose hope and ambition and give up. Thenceforward, if left to their own resources, they are the victims, not the masters, of their environment; it is a bad master. The bad master becomes the heredity of the next generation."

Can we honestly say that there has been any real improvement since Jacob Riis wrote in 1902?

"The slums take their revenge," said the poet Carl Sandburg. We can no longer afford this revenge on the mass scale of today's slums. ☐

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Federal Programs Related to Rehabilitation

Through a long, evolutionary process dating back nearly 20 years, rehabilitation has become a keystone in Federally-aided housing programs. Whether in urban renewal, public housing, FHA-insured housing, or in our newest effort, model cities, rehabilitation is now recognized as a basic ingredient necessary to supply housing for lower income groups.

This emphasis on providing housing for low income and middle income families has pervaded the philosophy and actions of both the Kennedy and Johnson administrations. Their recognition of the immense urgency of taking decisive, productive action to provide such housing has brought with it the realization that, (a) new construction alone could not hope to fill the gap, (b) remedial action would have to be taken on a neighborhood basis, and (c) tackling a neighborhood's poor housing would be useless without a concomitant assault upon the social and economic problems of the people living in those neighborhoods.

During the past six years a number of new programs involving rehabilitation have been introduced. They have involved experimentation with interest rates, new patterns of home ownership, various types of public housing, and new attempts in the coordination of private and public efforts.

As recently as a year to 18 months ago, an observer of the housing and redevelopment scene could state fairly accurately that the programs of rehabilitation still contained more promise than progress, more paperwork than production.

Today, however, it is just as accurate to state that we are beginning to see real daylight in rehabilitation. We are beginning to see programs become practical reality. We are beginning to get a clearer focus on what the nature of the difficulties are. And we are beginning to find solutions to some of the more basic difficulties.

Some of the major difficulties are:

1. Financing. Obtaining financing to restore rundown properties has been difficult in many deteriorated areas, impossible in others.

2. Cost. The cost of repairs, even relatively minor ones, is beyond the incomes of some owners, particularly the elderly.

3. Displacement. Because of the shortage of decent housing for low income families, rehabilitation should be applied where it will result in minimum displacement. This has been an inhibiting factor.

4. Neighborhood Improvements. Only recently has there been a recognizable shift to housing improvement on a neighborhood basis. This requires environmental improvement as well, street improvements, installation of playgrounds and parks, tree plantings: a city rather than home owner responsibility.

5. Social Services. Once the neighborhood concept has been adopted, the need for improvement of the social and economic well-being of neighborhood residents becomes imperative. The requisite social and welfare services are also city responsibilities.

6. Lack of a "rehabilitation industry." Rehabilitation has too often been a catch-as-catch-can affair, carried on by craftsmen on the side. Whatever characteristics of an industry it has, it is so fragmented as to have only a slight impact on the problem, which requires a major effort by an integrated, cohesive industry.

HUD Programs

Now, what are we in HUD doing about these difficulties? Some of the answers are being produced in our various programs. While not all of them by any means are directed at rehabilitation solely, it is interesting to notice how many of them are finding rehabilitation the source of their greatest challenge, and some of their best productivity.

Take for example, the Low-Income Housing Demonstration Program created by Section 207 of the Housing Act of 1961. It authorizes the administration to enter into contracts to make grants to public or private bodies or agencies for developing and demonstrating new and improved housing for low-income and eligible handicapped persons and families at a cost they can afford to pay.

Forty-two demonstrations in 29 localities in 19 different states and the District of Columbia were under contract or completed as of December 30, 1966. These include eight demonstrations devoted entirely to rehabilitation.

One of the more dramatic demonstrations is the 48-hour rehabilitation project just completed in New York City. This is a joint venture with FHA, which has insured the mortgages. Making use of the "systems engineering" approach, this project has already shown great potential toward reducing the time for rehabilitating tenement and other buildings.

It involves a system for rehabilitating five- and six-story tenements by combining new engineering methods with preassembled components, resulting in a reduction in the time and cost of rehabilitation.

New materials and technology being used are showing the way for substantial cost savings. Industry is participating with the contractor in development of needed new products for rehabilitation. Among the

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items developed thus far is a plastic coated wood-particle flooring material, a new window unit for rapid replacement of old windows, prefinished wall material, a special easily leveled closet, and a new type of ceramic tile with a vinyl joint.

The engineering firm in charge of this project not only surveyed the building materials and components field for appropriate new products, but also developed a unique system for introducing into these old tenements the basic utilities of a modern American home: bathroom, kitchen, heating unit, and the plumbing and wiring to serve them.

All of these facilities were built into a single core, which was assembled off the building site. The assembled cores were then trucked to the site, lifted by cranes to the roofs of the tenements, and lowered into place through holes cut through the roof and each floor. The cores were thereby stacked, and, through cross bracing and the structural strength of the cores themselves, actually served to bolster considerably the structural soundness of the buildings.

Another significant but not as well known project is the one HUD funded in Washington, D. C., a demonstration of the possibilities of expanding the housing supply for large-size low income families through leasing of privately-owned homes by the local housing authority. The HUD grant enabled the housing authority to lease 50 older homes, and to provide the needed educational and social services to help the families adjust to their new surroundings.

Most of the homes were in fair condition at the time of leasing. All had to conform to the local housing code before they could be occupied. Owner investment in rehabilitation ranged from $100 for painting a room to more than $4,000 for a home that had been severely vandalized. Average cost of rehabilitation was $1,500 per home.

The experiment has been so successful that the national housing legislation now includes leased housing as part of the public housing program.

The program operated under Section 314 of the Housing Act of 1954 is somewhat similar to Section 207. It is a program to develop and test innovative methods for preventing and eliminating slums and blight, and to report the results for the benefit of other communities. Grants are made for up to two-thirds of the cost.

There are 74 such projects in execution or completed, including 13 directly concerned with rehabilitation. Studies include such titles as "Residential Rehabilitation," "Economic Aspects of Urban Renewal," "Prospects for Rehabilitation," "The Tenement Landlord," and "Neighborhood Conservation in New York City."

These have shed new light on the characteristics of rehabilitation problems. They have explored landlord-tenant relationships, the effects of home ownership on maintenance, community organization of slum residents, possible solutions to the financing difficulties in rehabilitating run-down properties, and many other complicated issues, human and physical, in rehabilitation work.

Most of the housing programs under the jurisdiction of FHA provide for rehabilitation as well as new construction. Of particular interest in housing low-income families are the programs available under Section 221 of the Housing Act, as amended. These are the below-market-interest-rate program and the rent supplement program.

The below-market-interest-rate program provides for mortgages up to 40 years at 3 percent interest. Public, nonprofit and cooperative mortgagors are eligible for 100 percent mortgages, of which the basic limitation is the estimated rehabilitation cost plus the lesser of the purchase price or estimated value before rehabilitation. Another eligible mortgagor is the limited dividend sponsor. In this case the mortgage is limited to 90 percent. The mortgagor receives a 6 percent return on the 10 percent equity.

The 114th Street Project

One of the best known projects under this section is on 114th Street in New York City. Thirty-seven old-law tenements containing approximately 450 units are being rebuilt by a local builder at a cost of approximately $13,500 per unit. The cost is less than new construction in this area. Because rents are subsidized by public and private funds, they are low enough for the majority of the occupants. As we get more experience with this project, we expect the results to require less subsidy aid.

This block, formerly used by drunks, narcotic pushers and the like has now been cleaned up considerably. Police protection was improved. Trash and garbage collection is now much improved through installation of garbage chutes in the apartments.

This project has many of the characteristics of a model neighborhood demonstration. A civic organization sponsored it. The occupants were consulted during the planning and their requirements and desires considered. Better police and social service facilities were provided. The Office of Economic Opportunity and the Low-Income Housing Demonstration Program joined with Federal Housing Administration and the New York City Rent and Rehabilitation Administration to provide basement space for use as a nursery, welfare workers, employment office, vocational training, and a rent supplement program for those occupants presently unable to pay the higher rents.

Rehabilitation is also encouraged under the rent supplement program. The Housing and Urban Development Act of 1965 includes an authorization to make payments to owners of authorized multi-family housing projects to supplement the rents that low income tenants can afford to pay. The basic program is under Section 221(d)(3), but at market interest rate, which is presently 6 percent. It covers both new construction or rehabilitation of multi-family housing projects with private non-profit, limited distribution, or cooperative housing corporation mortgagors.

About 10 percent of the 15,000 units for which rent supplements have been allocated by FHA involved rehabilitation. In the Washington Park area of Boston, two projects involving rent supplements in rehabilitated dwellings are being undertaken. They include 568 homes. A 22-unit project is being undertaken in the Hough area of Cleveland.

Two other rehabilitation programs recognize the difficulty of obtaining funds for remodeling and repair in deteriorated neighborhoods.

One provides for direct rehabilitation loans to property owners. An owner-occupant of a property of one or two living units and an income of $3,000 or less, may qualify for a loan, or a grant up to $1,500, or a combination of both. The loans, limited to the cost of rehabilitation, are for periods up to 20 years and the maximum interest is 3 percent. The properties must be in an urban renewal area or a code enforcement area and the rehabilitation work must cure all code violations.

The other is direct grants of up to $1,500, to enable low-income home owners in urban renewal areas and areas of concentrated code and enforcement to bring their homes up to required standards.

Rehabilitation is also involved in federally-assisted code enforcement programs, under which HUD makes grants to cities for up to two-thirds of the cost of planning and carrying out such activities in deteriorated areas. The program is not limited to urban renewal areas.

Experiments in Public Housing

A great deal of experimentation is also going on with rehabilitation in public housing. Here a "quiet revolution" is taking place. Public housing authorities are utilizing both the new "turnkey" operation, where they purchase housing from private builders or owners, and leasing of private homes for public housing use. Both provide additional sources of housing for low income groups more quickly than new construction.

A total of 1,000 units is under construction or completed in Philadelphia under a rehabilitation-turnkey operation, and several thousand more are under consideration. This is the largest such program, by far, and it has had its problems, but 400 homes are occupied and the lessons learned here will be valuable elsewhere.

All told, in urban renewal areas there are now some 200,000 units scheduled for rehabilitation, in addition to more than 86,000 units which have been completed. This is a significant increase over a year earlier, when there were 120,500 units scheduled and fewer than 66,000 completed. However, we should take note of the character of the buildings that have been rehabilitated. A high proportion of the 86,000 were owner-occupied. We have had much more success in getting owners who live in the deteriorated buildings to rehabilitate them than we have with absentee owners of large-scale rental properties. This remains a basic problem for comprehensive rehabilitation efforts.

Over-all, rehabilitation, while not yet a significant force in rebuilding our cities, is proceeding at a much more rapid pace than at any time in the past.

We expect rehabilitation to play a substantial role in the Model Cities Program. This is a new program, designed to improve substantially the living environment and the general welfare of people living in slum and blighted neighborhoods in selected cities of all sizes and all parts of the country. It calls for a coordinated attack, bringing to bear the resources of federal, state, and local government as well as private efforts, to develop "model" neighborhoods.

The philosophy of the program has been well expressed by President Johnson. He has set as a goal, "To build not just housing units, but neighborhoods, not just to construct schools, but to educate children, not just to raise income, but to create beauty."

The program is therefore designed to develop a total attack on the social, economic, and physical problems in slum and blighted areas. This means a comprehensive, coordinated, and concentrated effort to mobilize all available resources to rebuild and revitalize the physical environment of blighted neighborhoods and improve significantly the lives of the people living in them.

As our program guide states:

"The over-all emphasis of the physical improvement activity in the program is on rehabilitation. Therefore, as a general rule, model neighborhood areas should contain substantial numbers of residential buildings that can be rehabilitated."

The guide also underscores the necessity for enlisting the support and participation of private enterprise. It stresses that one of the ways in which private enterprise can be involved is encouraging and assisting builders and contractors in rehabilitation, and also in the research and developmental work needed to take rehabilitation out of the handcraft stage.

Some private firms are already deeply committed to making rehabilitation work. Recently, Secretary Weaver awarded the HUD "Urban Pioneer" medal to the U.S. Gypsum Company for its leadership in experimenting with rehabilitation in a deteriorated building in New York City. The firm has acquired the remaining six buildings in the same block, and will enhance the area's rehabilitation effort with a mall.

It has also acquired buildings in the Hough area of Cleveland and is undertaking rehabilitation studies in several other major cities.

Smith, Kline, and French is cooperating in the rehabilitation of buildings in the area in which its plant is located in Philadelphia. And private industry has helped immeasurably in the 5th Street and other projects mentioned earlier.

Such national firms as Warner and Swasey, the American Plywood Association, and Armstrong Cork Co. are substantially involved in rehabilitation planning and activities.

President Johnson's recognition of the importance of an effective rehabilitation job was shown in his recent "Message on America's Unfinished Business." He stated:

"Rehabilitation is . . . crucial to the success of the model cities program.

"I intend to call together an outstanding group of private citizens from across the country—from business and labor, government and the building industry—to examine every possible means of establishing the institutions to encourage the development of a large-scale efficient rehabilitation industry.

"I will ask this group of outstanding Americans to find the best ways to tap the enormous market that exists in rebuilding our cities and to bring the most modern systems and the most advanced technology to this urgent task."

Need for Government Commitment

But rehabilitation is a most uncertain undertaking and we cannot expect private enterprise to commit itself to rehabilitation on the necessary large scale without a commitment from government to assure a steady, long-run market. Government should develop the incentives that are necessary to attract private capital, initiative, and organization. Government should provide the required mortgage financing, even, perhaps especially, at times when money is tight.

Government means not only the federal government. Local governments can play a most important role in stimulating and maintaining rehabilitation. Tax abatement incentives, subsidies for experimentation, and organizing local non-profit groups and other private sources are a few possible local government contributions.

In addition to private industry we need the cooperation of the great labor organizations to make rehabilitation work. We expect many new jobs to be created through the massive rehabilitation task we visualize will be engendered by the Model Cities Program.

Frankly, we expect a new industry to be created which will make much more effective use of the giant homebuilding industry.

But can this mass rehabilitation industry develop without more flexibility in craft practices? One of our legislative mandates is to make sure that residents of the model neighborhood benefit from, and receive a priority for, new jobs created as a result of the model neighborhood program efforts.

Surely, the greatly expanded rehabilitation job that will be necessary to bring model neighborhoods into standard condition will require a greatly expanded work force. There should be plenty of jobs for all willing hands.

Will the use of new technology, also mandated by Congress, be encouraged, ignored, or thwarted by the building trades and contractors? History teaches one lesson over and over again: the introduction of new technology always results in expanded employment. Many new breakthroughs in rehabilitation technology are in the immediate offing, and we should be organizing now to take advantage of them.

Another major point made in the guide that is closely related to successful rehabilitation efforts is maximum use of new and improved technology and design, including cost reduction techniques. Here the guide states:

"The program should spark innovation in the application of new and improved technology and design, and in the development of cost-reduction techniques. The volume of construction activity generated by the program should create a significant market for such innovation, and cities should develop procedures to capitalize on this opportunity. Local public officials, union leaders, mortgage lenders, material suppliers, and the real estate and construction industry, among others, should engage in an active effort designed to bring to housing production the methods now possible through technological and managerial advances, modern building and housing codes, and up-to-date building practices."

There you have the range of federal aids for rehabilitation. It is an impressive array, but, as I noted earlier, not nearly as productive as we would like. The problems and obstacles are most formidable. Yet, rehabilitation is the hinge on which most of our efforts to reclaim and build our slum and blighted areas will pivot. The massive impact of model cities will create many new jobs, which are of vital importance in upgrading the lives of residents of target areas. We need the housing and the employment. Therefore, rehabilitation must be made to work.

How? First, by expanding on the solutions we are beginning to discover, through a greatly augmented research program.

Second, by creating a rehabilitation industry from what is now a non-industry, so that the massive job of rebuilding can be undertaken on a scale commensurate with the problem.

Third, by tying in rehabilitation much more closely with the people in the area, and keying it into area-wide efforts in other fields, community facilities and employment, in particular.

Fourth, by much closer working cooperation between industry, labor, and finance, and local, state and federal governments. This involves, not only the resources, but the understanding of the need for such an effort and how it can affect the target area residents directly.

As Secretary Weaver has said:

"Rehabilitation as a major part of our efforts to remake the cities is not a job that is far off in the future somewhere. Nor is it one that we speak of as coming during our lifetime. We expect to make a major impact on it during the next ten years.

"Rebuilding a neighborhood or a city can be compared to modernizing a plant in industry. When a neighborhood is renewed and renovated, we have done more than make a plant operation work better—we have paid off an obligation shared by business and government, to see to it that every citizen can live in decency and dignity." ☐

Mr. Taylor is a former Vice Chairman of the Executive Committee of the National Association of Housing and Redevelopment Officials and a former member of the Board of Directors of the National Association of Home Builders. He received his B.A. and M.P.A. from Harvard University and his M.A. from Louisiana State University.

A Plan for Mass Housing Rehabilitation Corporations

IN THIS ERA of over-all prosperity, the housing inventory for families of low and moderate income continues to deteriorate in American cities, and far too little is being done about it. These families have been forced out of the good housing market and are condemned to live in deprivation and squalor, usually through no fault of their own.

The social and economic costs of this neglect are enormous, both to white and Negro families, and to the nation itself.

There is nothing new about this situation. Housing blight has been spreading for generations, at an ever-increasing pace. It seems that we, a nation of builders, have not learned the economics of rebuilding.

Today, however, there are stirrings which indicate that constructive action can and will be taken to stem this tide of housing obsolescence in the nation's cities.

The big question everyone seems to ask is: Can rehabilitation produce a profit and still produce housing for low and moderate income families? The profit motive built all our older houses that exist today. Can it rebuild them?

The Pittsburgh story of building and rebuilding over the past 20 years is well known. Redevelopment is a never-ending job. The more a city does the more it comes to realize that what has been done seemingly has only scratched the surface. This fact comes into sharp focus, particularly when the enormous socio-economic task of revitalizing aging neighborhoods is undertaken.

Until recently, the attack on the problem has centered on complete obliteration of neighborhoods, with the resultant dislocation of large numbers of people, which in turn has led to accelerated decay elsewhere. We are now experiencing a quickened and encouraging exploration of the potential of renewal through rehabilitation of basically sound structures.

From the public point of view, it is clear that a massive effort is needed to turn this potential into a meaningful reality in a reasonably short period of time. The most likely source for this kind of effort is the private sector, particularly our large corporate entities with their tremendous resources in human talent, technological know-how, financial strength, and problem-solving capabilities.

From the private point of view, the motivation for an individual company's involvement in this effort may vary from one company to another. But whether it be enlightened self-interest for those that have a direct stake in the general community environment, or the acceptance of the challenge of civic responsibility, or direct commercial interest in terms of enlarging the market for products and services in the housing field, here is another opportunity for business to demonstrate what it can achieve through the appropriate application of its capabilities in an area of broad public concern.

The profit motivation for those companies whose capabilities mesh with the commercial opportunities inherent in this field should not be de-emphasized. To be perfectly pragmatic, in the long run this motivation offers the most prolific provider for human needs and wants yet known to man.

What is called for, then, is a mechanism which can successfully blend all of these motivations into a single concerted attack on the problem of mass housing rehabilitation and at the same time provide a laboratory for experimentation in this field through which individual companies can gain experience and confidence, and ultimately, hopefully, proliferate this effort on an ever-expanding scale.

This is really what the following ACTION-Housing proposal is all about.

BERNARD E. LOSHBOUGH, Executive Director, ACTION-Housing, Inc., Pittsburgh, Pennsylvania.

Allegheny Housing Rehabilitation Corporation

This proposal recommends the formation of a new corporation to engage in the rehabilitation of structurally sound but deteriorating housing in the Pittsburgh area, in cooperation with the local, state and federal agencies.

The Pittsburgh demonstration by the proposed Allegheny Housing Rehabilitation Corporation (AHRCO) would, when experience has proven it successful, constitute a prototype which could be repeated in many cities throughout the nation.

Participating companies could commit to purchase common stock or debentures. Policy would be established by a board of their selection. Professional staff and management personnel would be provided by the newly created company (AHRCO).

Proposal. Allegheny County contains 503,000 dwelling units, of which it is estimated approximately 90,000 need and are susceptible of rehabilitation. Of these, 40,000 are in the city of Pittsburgh. Thus, in the city alone, assuming an average cost per unit of $10,000 for acquisition and rehabilitation, there is a $400 million market. A total of approximately 17,000 dwelling units in the city and county are beyond restoration and should be demolished.

The 5 million dwelling units in the nation eligible for rehabilitation constitute a $50 billion market.

Total clearance and redevelopment of the areas in which these units are located are monetarily and otherwise not feasible. Public housing in Pittsburgh has averaged less than 325 units per year in the last 30 years, although the rate has increased in the last few to about 430. At this rate, including consideration of private building and rehabilitation, the inventory of substandard housing will inevitably increase.

As a demonstration, ACTION-Housing, Inc. undertook in 1966 the rehabilitation of 22 row houses on Cora Street in the Homewood-Brushton area of Pittsburgh. ACTION-Housing acquired the properties for about $4,000 each and expended approximately $6,000 additional per unit to provide good housing for 22 families in that neighborhood at a rental only slightly higher than previous payments.

Construction work was performed by a private contractor; interim financing was provided under a participation agreement by the Mellon National Bank and Trust Company and the Development Fund of ACTION-Housing. The permanent mortgage financing was obtained from the federal government under its below-market interest rate program (Section 221 (d) (3) of the National Housing Act), which provides 3 percent funds, and up to a 40-year mortgage term for 100 percent of the total costs where the mortgagor is a nonprofit corporation such as ACTION-Housing, Inc. Limited dividend corporations could secure a mortgage for 90 percent of the total costs.

The Cora Street rehabilitation has had a distinct advantage in being located in a neighborhood which has a strongly structured Citizens Renewal Council, a pioneer urban extension group which ACTION-Housing helped to organize and has given professional guidance to over seven years. The Council has leadership and participation by neighborhood people, as well as backing by the major industries and merchants of the neighborhood. When Cora Street was first publicly announced, the then President of the Council said: "The modernization of whole sections of basically sound housing will provide the visible evidence of change that should inspire us all."

Although Cora Street has demonstrated obstacles and need for changes in procedures, the following conclusions were reached:

1. Such work is feasible and provides a good end-result for tenants of low and moderate income without major dislocation. Tenants are happy with the housing.

2. A reasonable profit is available to developers, subject to normal business risks, and to persons providing services, such as architects, contractors, lenders, attorneys, and realtors.

3. This form of private enterprise development provides advantages in cost, markets and time over new construction and other current housing programs.

4. Major expansion of this concept requires substantial capital, and private enterprise production techniques and purchasing power.

5. Such an undertaking provides an immense sociological benefit to older neighborhoods in decaying urban communities, an urgent necessity in halting further deterioration and social strife.

Major capital, private enterprise methods, and the affirmative cooperation of federal, state and local governments are essential to provide quantity rehabilitation for impact upon Allegheny County communities.

The federal government, through the Department of Housing and Urban Development's Secretary, Robert C. Weaver, has expressed great interest in this effort and a willingness to give it strong support.

The Secretary explored with a number of ACTION-Housing's Board of Directors various forms this support might take. They include steps to relieve red tape and, at least initially, to assure the financing mechanism essential to this process.

Continuity of such financing support is dependent upon future Congressional action.

The City of Pittsburgh, the City Planning Department, and the Urban Redevelopment Authority, have also indicated their full cooperation for such an undertaking.

Mayor Barr stated: "Please be assured that the City of Pittsburgh will make every effort to implement the matters contained in your proposed agreement with HUD and in the development of this undertaking. This proposal, if effected, will be a vital step in our entire renewal program, and particularly for our Model City proposal."

A brief survey by qualified appraisers indicates that sufficient housing might be acquired on the open market to initiate a major rehabilitation program. Continuation of the program over an extended period will require close cooperation of the Urban Redevelopment Authority. As the program progresses, high annual rates of acquisition will force the market up, but the Urban Redevelopment Authority, by providing necessary "write-downs" where possible in conservation areas, can mitigate this cost factor. This cooperation would make it possible for AHRCO to rehabilitate old housing for families of low and moderate income at a monthly cost they could afford to pay.

The Allegheny Housing Rehabilitation Corporation would acquire housing units, arrange for interim financing, secure architectural services and perform or contract for their rehabilitation.

Completed units could be sold to eligible nonprofit corporations, limited dividend entities, cooperatives, or individuals, approved by FHA and eligible for the Special Assistance Mortgage programs available under existing housing acts. An alternative approach is the sale of units to public housing agencies under the so-called turnkey program. The corporation also would have the option of retaining units for long-range investment.

Inasmuch as no housing rehabilitation industry exists today, major development effort will be required of material suppliers, architects, contractors and labor. New materials, methods of work, training programs for business and labor, and financing are indicated for long term success of a major housing rehabilitation program.

Recommendation. The proposal recommends that the major Pittsburgh-based companies and others, to the extent that they are interested in housing rehabilitation, form an operating company (AHRCO) capitalized at $3 millon to $4 million for the purpose of buying structurally sound but substandard housing principally in, but not limited to, Allegheny County, rehabilitating and selling, or holding and renting it.

The level of financing suggested is believed to be sufficient to build up to and sustain a rate of 1,000 housing units annually, provided that housing units are turned over in about one year. Based on calculations, cash flow would be sufficient in the fifth year after formation to commence payment of dividends.

It is also recommended that a nonprofit research organization be formed to which AHRCO would subscribe 10 percent of its gross profits. The research company, with grants from foundations, government and AHRCO, would sponsor research on construction methods and material application problems requiring solution.

Upon acceptance in principal of this proposal by a sufficient number of companies, ACTION-Housing would undertake to form a shareholders committee to draw up the required agreements for formation and financing of the proposed operating company (AHRCO). After formation of the company, ACTION-Housing, Inc. would be retained by it in a consulting capacity.

The structure of the proposal indicates that no financial losses would be incurred by the group of companies subscribing to the development corporation. We believe there would be a profit from the sale of houses. This is not the primary incentive, however, nor is the sale of products, which may well be minimal in the beginning for some industries. A huge rehabilitation market does exist, and there is an exciting opportunity and challenge to develop it on a profit-motivated basis.

The major corporations whose interest has been kindled by the proposal see their real benefits as being the rebuilding and enhancement of the total environment of American cities, where most of them are located and where most of their employees live and work.

Here is where the wide-open, challenging potential in the rehabilitation of housing lies: for American industry to take the lead, with the cooperation of the public sector, in revitalizing the total environment, whole cities, not just neighborhoods and not just housing alone.

Although good housing constitutes the keystone of a sound community, no one thinks that the provision of housing, new or rehabilitated, will, of itself, solve all the social and economic problems plaguing our cities.

The more basic undertaking is to open up opportunities for social and economic stability for that large segment of the population, white and Negro, which is poverty-stricken. This calls for engagement of all our industrial, governmental and civic resources.

However, mass rehabilitation of existing housing for families of low and moderate income has been caught in an economic stranglehold. Its progress stands still in the immovable heart of a nation on its way to the moon.

In many respects, it seems to me that the space program is easier to develop than housing rehabilitation. Without minimizing the difficulties, the launching of astronauts into space has all brand new complexities to deal with; it is not encumbered by the dead physical weight of two or more generations of obsolete and ill-maintained housing structures, the hodgepodges that have usurped much of the land in our cities.

The problem has existed and been defined for generations. This generation has the knowledge and tools to create a major new industry that will solve it. ☐

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Standards for Rehabilitation of Housing

WHEN THE SUBJECT of appropriate physical standards for the rehabilitation of run-down and dilapidated residental properties is considered, the first and foremost factor should be to meet the minimum needs of people, of 20th century American citizens.

Secondly, a determination must be made of what is necessary to overcome chronic neighborhood neglect and significantly reverse the slum-creation process.

A third important consideration is that the level of rehabilitation must be directly related to how much the work will cost and how it can be made financially feasible. To be meaningful, the "work" should include the immediate environment as well as the property itself.

Achieving these three basic objectives involves a difficult and delicate process. The special conditions of each locality and neighborhood must be known, and the degree of physical improvements determined by how best the building, project of buildings, or the area will meet the basic objectives.

Federal Rehabilitation Standards

Standards for residential rehabilitation can bear little resemblance to commonly accepted standards for new construction. This is because the standards apply to contemplated work on existing buildings on existing lots, of different construction types, and at different stages of deterioration. Nevertheless, the experience of the construction industry must be translated into certain mandatory requirements as well as into guidance material of an optional nature that can be used wherever locally appropriate and financially possible. This has been the method used by the Department of Housing and Urban Development in establishing rehabilitation standards.

FHA's Minimum Property Standards for Urban Renewal Rehabilitation (FHA No. 950) were developed by the FHA four years ago in close collaboration with the former Urban Renewal Administration, now named the Renewal Assistance Administration. This document is not a set of standards in itself but constitutes a guide for the establishment of local rehabilitation standards for certified urban renewal areas. FHA No. 950 covers all aspects of a residential property, including such things as site, building planning, fire protection, materials, construction, exterior and interior finishes, and mechanical equipment. It contains a series of mandatory requirements that can be deviated from only under special circumstances. The mandatory items deal with elements of health, safety and structural soundness and are at the levels contained in nationally recognized model codes.

Another group of items are recommendations of good practice, if suitable for the particular area. However, the precise level to be established on these subjects or their omission is left to be determined locally in relation to the incomes and paying abilities of the residents, the living standards of the people in the neighborhood, and the marketability of the properties.

The essential characteristic of these standards is their flexibility to meet local conditions. These local conditions can best be determined by detailed discussion and joint inspections of typical structures in a contemplated rehabilitation area by the parties concerned, namely, the representatives of the local public agency and of the FHA. On reaching reasonable conclusions, the FHA agrees to insure loans on any property in the area which is brought up to the standards agreed upon, provided the credit rating and income of the borrower are acceptable. Cities all across the country have established rehabilitation standards for their local areas based on this method.

The Housing and Urban Development Act of 1965 authorized HUD to provide federal assistance for concentrated local code enforcement programs. Where

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FHA participation is needed in local areas of this kind, the MPS rehabilitation standard, FHA No. 950, is used as a guide to determine the technical level of the local codes and the type of enforcement. Where all or most of the mandatory requirements are met, and the economic and social conditions of the neighborhood justify, the program is considered acceptable to the FHA.

At present, FHA is developing rehabilitation standards and guides which will be appropriate for locations outside of either urban renewal or code enforcement areas. Hopefully these standards will be appropriate as guides for the rehabilitation of large apartment buildings which are presently considered on an individual basis.

Questions That Need Answering

The question is occasionally asked: "Why have standards for rehabilitation work when conditions vary so much from city to city and from building to building?"

Standards and guide material are needed to overcome a considerable lack of "know-how" at the present time of how to do this kind of construction efficiently and satisfactorily. They are needed to protect residents against a portion of those in the slum property business that would overcrowd buildings in order to squeeze out more income, or would use inferior materials and poor construction methods to increase quick profits. The term "sub-standard" housing is frequently used. What does it really mean? It implies that there is a level of housing and living conditions for American citizens that should be our housing objective for all. I think we can easily accept this objective, and yet it is said that from 10 to 15 percent of our citizens live under sub-standard housing conditions.

Likewise, minimum rehabilitation standards are needed to aid the judgment of the overly-ambitious designer or sponsor that would over-improve slum buildings, so that the future financial burdens on residents will not be excessive, as well as to help avoid unsound business ventures. Decisions must be made on each deteriorated property of whether to repair, or "gut" the interior and replan, or whether to clear the land and start over. The "as is" value of each existing property also must be determined. To make these decisions wisely, written guidance material is greatly needed.

Another question asked is: "Why can't we just go by local codes for this kind of work?"

Building codes address themselves to new construction primarily and housing codes emphasize safe living conditions, sanitation, and the proper maintenance of properties. Codes do not, of themselves, assure the creation of desirable or marketable properties or create a good living environment. Rehabilitation standards should provide the guidelines for accomplishing this. Although this kind of design and construction work needs some basic requirements to be met, there must be also a maximum of flexibility in deciding how best to accomplish the objectives. In this way the new sophisticated construction methods can be used as well as the simple methods which sometimes must be executed by largely untrained workmen.

Codes are of necessity made up of provisions that apply city-wide, or throughout a larger political jurisdiction. Rehabilitation work often operates so close to the borderline financially that city-wide regulations need to be modified wherever it can be shown that present material or equipment is in good condition and does not need replacement. A building by building work sheet or list of work items prepared by a team of technicians inspecting each structure will provide major economies as compared wtih automatic compliance with city-wide regulations based on new construction thinking. Technically valid rehabilitation standards and guides are therefore needed locally to decide what work needs to be done in each building. Optimistically, it is hoped that in future years, local communities will develop separate codes for rehabilitation work. Such a code should emphasize performance concepts, thus making possible maximum economies.

A third question is: "What are the ingredients of successful rehabilitation work?"

There are several:

1. The legitimate aspirations of slum dwellers for a decent place to live must have been fulfilled.
2. The results must create interest and appeal to potential residents.
3. The construction must be sound and safe, and should be vandal-resistant and of a lasting quality.
4. The economics of the project must work and the financial burden on the residents must be bearable.
5. The street or neighborhood must have been made a safe place to live.
6. The neighborhood must have begun to be active, have variety, and provide enough space for the recreation of children and youth that residents will accept or even enjoy living there.

Looking Ahead

The actual techniques of successfully doing rehabilitation work are only beginning to be developed. Because of the vastness of the problem of slums, great organized efforts across the nation must take place. This indicates that rehabilitation planning must not have unwarranted restrictions, and that the construction stage must take place with great speed. Therefore, off-site fabrication of components becomes an important aspect to consider. More standardization is needed of useful materials providing durability, ease of handling and assembly, and economy. Without a doubt, frequent adjustment of codes and rehabilitation standards will be needed to keep up with technical developments. It will be essential that the key word of this process be flexibility. ☐

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Building Research
JAN-MAR 1968

Rehabilitation in Boston

EARLY IN 1961 the Boston Redevelopment Authority, under renewal chief Edward Logue, established a new organizational framework to carry out an ambitious program of renewal that had as its keystone the rehabilitation of properties in our older neighborhoods. While other cities were still planning with the bulldozer, Boston's program placed major emphasis on renewal with the paint brush and the saw.

There are 10 General Neighborhood Renewal Planning Areas in Boston and 6 Improvement Areas. Our glamorous projects, such as Government Center, Waterfront, West End and Prudential involve primarily new structures. The Residential Rehabilitation projects are Washington Park, South End, South Cove, Fenday, and Charlestown.

All of these projects are different not only in topography but in types and kinds of structures and most certainly in the makeup of the residents.

Washington Park

The Washington Park area is predominantly residential, and contains 502 acres. Over 1557 properties containing 5700 dwelling units were scheduled for rehabilitation.

We do not have a predominant building type in Washington Park, but the Boston "three decker" may be in a majority. This is a wood frame, 3 family, flat type apartment. There are many large, obsolete, single-family homes which have been converted to multi-family dwellings, and some masonry row type structures as well as detached multi-family masonry apartment houses. Most of the buildings were built around the turn of the century except for the large apartment houses which were constructed just prior to the crash in 1929. There had been almost no residential construction in Washington Park since the late 1920's.

In 1950 the makeup of the area was 80 percent white and 20 percent Negro. In 1960-62 these figures had been completely reversed.

We attacked the job of rehabilitating these properties with a task force of technicians, designers, finance specialists, community organizational people and rehabilitation salesmen.

Very early in the program we established a site office not only as a workshop for our team but to make it a one-stop rehabilitation shopping center. The Boston Banks, which formed an urban renewal group and set aside $20 million for rehab loans and mortgages,

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assigned people to work in our site office and process rehab mortgage loans. The FHA also assigned staff people to work out of our project office to service property owners with long term insured rehab mortgages. You must understand that improvement loans and mortgage money were virtually unavailable in this area for over 10 years. Fire insurance, if you could get it, was secured through Lloyds of London at two to three times the manual or city rate.

In Washington Park many of the rules and regulations regarding renewal and rehabilitation were examined and applied with a broad or literal interpretation depending on which would get the job done better, or quicker, or more completely. In some cases, waivers from the regulations were requested; in others, the book was re-written.

To date, as a result of almost four years of service and commitment to the property owners in Washington Park, over $6,300,000 has been invested in the rehabilitation of almost 5300 dwelling units. Over 4,000,000 rehabilitation dollars have been insured by the FHA.

Probably the greatest single thing that has happened to rehabilitation since the Housing Act of 1949 and later amendments in 1954, has been the 1965 amendments, Section 115, Direct Grant, and Section 312, 3 percent loan for rehabilitation. We have taken full advantage of this 3 percent money. In many cases we have actually rewritten the existing mortgage and rehabilitation cost at 3 percent for 20 years.

Did rehabilitation pose any unsolvable technical problems? In general, no; most of our rehabilitation work was done by tried and true conventional methods and did not involve the relocation of large numbers of people.

Boston's program is not a clean up-paint up-fix up operation. It would be dishonest of us to come into an area like Washington Park with an approved 40 year plan, and expect to make minor improvements that would have to be re-done in five years or less. In Boston, we stress a "gutsy" brand of rehabilitation, placing major emphasis on structural improvements, wiring (responsible for 80 percent of the working fires in the area prior to renewal), plumbing, automatic hot water, central heating, and the general livability of the housing stock.

Some of our larger apartment house rehabilitation required the relocation of families but the BRA performed the relocation and less than 1 percent of the total units rehabilitated required this action.

An area selected for rehabilitation emphasis requires the existence of, and plans for, some community facilities or areas of "anchor strength." Washington Park did have some strong anchors but required even more facilities and capital improvements to hold the community together.

Charlestown

Charlestown is separated by the Charles River from the rest of Boston proper. It is the only part of the city having a common boundary line with the cities of Cambridge, Somerville and Everett. It is an old, primarily residential neighborhood, rich in history and tradition. Here, two hundred years ago, the Battle of Bunker Hill was fought. The Charlestown Navy Yard is the home of the famous U.S.S. Constitution (Old Ironsides).

Like all old neighborhoods, Charlestown has problems. Probably its greatest strength is its people. Ninety percent of the homes in Charlestown are basically sound but blight has taken its toll: obsolete, deteriorated and abandoned buildings; narrow congested streets; poor street lighting; MBTA elevated structures bisecting the town; inadequate community facilities; and encroachment of industry.

Population has declined over the last 15 years and the valuation of the properties has gone steadily downward.

It must be understood that building conditions in a proposed rehabilitation project must be such that a large percentage of the properties are rehabitable. They must be in satisfactory condition, in need of minor repair or extensive but not major repair. Economic feasibility studies help in determining the probable success of a rehab effort. This may take the form of structural feasibility and people feasibilitiy studies, understanding that in general, the residents of a rehab area are expected to remain after the rehabilitation has been completed.

The brick row type and the wood frame row type structures are common to the Charlestown area of the city. Many of the party walls in these blocks are composed of 8 in. of solid masonry in the brick blocks, and in the wood frame blocks, either an 8 in. party wall that pierces the roof or a double 2x4 partition that acts as a party wall. In some cases, a single 2x4 partition, with brick nogging, serves as the party wall.

While this type of construction standard may have been acceptable around the turn of the century, and satisfactory to the pattern of living at that time, a rehabilitation effort must consider a standard that will be at once decent, safe, sanitary and modern.

Efforts must be made to take advantage of the advance in building technology, and to use the newer materials and systems that were unknown when many of these houses were built.

In Charlestown, many of the dwelling units contain ceiling heights as low as 6 ft 2 in. Many properties lack a reasonable second means of egress. Some of the very oldest properties were constructed by ships' carpenters who performed the framing operation in much the same manner as they would frame a schooner or square-rigged merchant ship, using 3x4 floor timbers spaced 18 to 24 in. apart, but employing two layers of boarding rather than deck planking. Much of the floor framing was not designed to carry modern appliances or furniture, particularly kitchens and bathrooms.

The process of determining a standard for rehabilitation for an area like Charlestown must consider the level for flexible items and the specific mandatory items that must be adapted or complied with, based on careful consideration of local conditions, local customs and acceptability, housing market, and last but not least, the average income of the area owners.

There is, however, a level of physical, social and economic conditions below which standards for rehabilitation should not be allowed.

South End

Our South End project is one of the largest in the country, containing one square mile of area and approximately 3500 buildings scheduled for rehabilitation.

The South End is two distinct communities: one is residential and the other is commercial-institutional. Fifty percent of the residential properties are owner occupied. The renewal plan calls for rehabilitation of 75 percent of the existing housing. The multi-racial population contains the largest number of elderly and transients in the city.

Much of the South End area was part of Boston's "Back Bay" that was filled in after the Civil War and developed for housing. Planned for the carriage trade, the South End enjoyed a relatively short period of graceful living. By 1900, when Boston's streetcar suburbs were at the height of development, it began to slip as a status or priority area into a gray, rather dreary inner-city nest.

The South End, as the gateway to downtown Boston, in 1963 had the highest incidence of crime and disease in the city. The average dwelling unit density is two and a half times that recommended by the APHA. There are a great many licensed and unlicensed lodging houses as well as over 100 licensed liquor establishments. The population in 1964 was 31,500 people; 25 percent of this total are over 60 years of age.

The typical property in the South End is masonry row-type, four or five stories in height, 18 to 24 feet in width, and 45 to 65 feet in depth. To emphasize our concern for the architectural beauty and symmetry of these handsome structures, our plan for the area incorporates the following: "The unique, unifying and harmonious predominance of brick facades shall be preserved, and the fronts of structures with such facades shall not be covered with sheathing or siding of any kind or design."

Wooden piles or mudsills were used on the foundations of many of these structures, particularly those built on the land stolen from the inner harbor. These piles require coverage from a constant water table and, in some cases, the water table has fluctuated, creating some rather horrible structural conditions. As we all know, rehabilitation must be predicated on the existence of a sound structure, and in the South End, rehab surveys pay particular attention to the structural conditions of the buildings.

There is no such thing as a typical ceiling height in this area. Floor timbers span from party wall to party wall and range in height from 14 ft 4 in. at the first floor to 8 ft 6 in. at the top floor.

Most of the rehabilitation dollars are spent on the interior of the building and, therefore, are not as visible as they might be in an area with more variety of structures.

The Boston Redevelopment Authority started comprehensive rehabilitation activity in the South End in June of 1966. To date, over $1 million in private investment in rehabilitation has been spent.

Fenway

The Fenway Urban Renewal Area is predominantly an institutional and residential project. It contains many large apartment houses, and small groupings of town houses and student lodgings that are scheduled for rehabilitation. More than 70 institutions, some of which are nationally and internationally renowned, are located in this area. Examples are: Harvard Medical School, Peter Bent Brigham Hospital, Childrens Medical Center, Symphony Hall, Mother Church of Christian Scientist, Museum of Fine Arts, Isabella Gardners Museum, and Northeastern University.

The project has received local and federal approval and should get under way this summer.

Over 100,000 Bostonians live in areas where urban renewal plans are already approved and being carried out. This is one-sixth of our population.

Rehabilitation is planned for over 35,000 dwelling units and to date over $11 million has been invested in residential rehabilitation. A relatively short time has passed in Boston's development period and only one project, Washington Park, has been in execution longer than two years. We have completed surveys on 11,800 units in our rehabilitation areas and have brought up to our standards for rehabilitation over 6500 units.

It has been estimated that the rehabilitation industry accounts for 1 percent of the Gross National Product. This indicates a volume of over $7 billion a year in the residential rehabilitation field. Yet how much money has been spent on research and technology to find better and easier ways to pump new life into our tired old buildings? How much money has been spent on methods of improving what are undoubtedly our least expensive types of housing stock?

Maybe the building materials suppliers look at a typical urban area slated for rehabilitation and think: How much brick and mortar or lumber or finish can I sell on a building that already exists?

Fortunately, the federal government, through its oft-maligned urban housing programs, is serious enough about this rehabilitation business to sponsor many demonstration programs in the rehabilitation field, and a handful of public spirited manufacturers have attempted, with varying degrees of commitment, to seek better ways of doing the rehabilitation job. ☐

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Rehabilitation in Philadelphia

RESIDENTIAL REHABILITATION is rapidly becoming one of the most vital aspects of community development. It is not a sole or simple solution for our community development problems. Throughout the brief history of renewal, the spotlight has focused on one program or another with various advocates claiming this "new breakthrough" will be successful where other programs failed. In three decades, we experienced shifts in emphasis; in the late 30's: public housing; late 40's: slum clearance; late 50's: rehabilitation; mid-60's: anti-poverty, and late 60's: model cities.

In Philadelphia, we are approaching the problem of community development with residential rehabilitation as one of the major building blocks.

It is my feeling that rehabilitation is essential and capable of solving many problems that cannot be attacked in any other manner. The type of a rehabilitation program which will work in slum areas, gray areas, transitional areas, or magnet ares depends upon the financial assistance available and the desired degree of rehabilitation.

In Philadelphia, we are still asking several haunting questions: Is rehabilitation meaningful if it displaces the present occupant? Is the rent supplement program a reasonable solution when moving a displaced occupant back into the rehabilitated house? Should the house be rehabilitated or should it be rebuilt so that it is almost maintenance free? What are our obligations to the family that buys the home in an impoverished neighborhood? If we have a half dozen families in such a neighborhood, what happens if one of these families wants to sell? Can we assure them of finding a buyer or are they stymied with their overimproved home and high mortgage?

Our experience has also created many questions. Probably one of the most important is: What is successful rehabilitation? We can rehabilitate a house, a block of houses, a neighborhood, and yet we may not have attained a desirable place to live. The converse is true also. Successful rehabilitation, therefore, will have to be defined individually for each program. Goals must be established and understood. They must also be reasonable.

J. EDWARD MITINGER, JR., Redevelopment Authority of the City of Philadelphia, Philadelphia, Pennsylvania.

Six Philadelphia Programs

Six programs are presently in operation in Philadelphia involving residential rehabilitation. The work of Smith, Kline and French is discussed in another paper.

A second program is a $20 million revolving fund established by four savings and loan associations. This is operating independently with realtors in our North Philadelphia area and in conjunction with other rehabilitation programs. The mechanics of this 20 million dollar fund involves the participation of an F.H.A. 220 mortgage. Its primary purpose is to provide financing for low-income home buyers who have no other recourse to mortgage financing.

Probably the most significant single aid for which this fund has been used is in cooperation with the Interfaith, Interracial Council of the Clergy. The I.I.C.C. is operating in North Philadelphia buying homes and rehabilitating them for sale to home buyers. This effort is still on a demonstration basis in deteriorated neighborhoods.

The third program involves the Philadelphia Housing Development Corporation. P.H.D.C. specializes in sale housing. To date, approximately 300 houses are in the process of being rehabilitated under this program. P.H.D.C. is a city agency which exists to accept abandoned properties from owners who are more than willing to be relieved of their responsibility of taxes and persistent notices from the Department of Licenses and Inspections. These houses are rehabilitated and then sold under a 220 program or a lease purchase arrangement. A portion of a million dollar estate which was established to provide non-profit housing for the "worthy working poor" has been used by P.H.D.C. to make the lease purchase plan work.

A fourth program is operated by the Philadelphia Housing Authority and is known as the Used House Program. A home builder obtains an option on a house, and contacts the Philadelphia Housing Authority to be assured that such a house is satisfactory for their purposes, and that they can agree on the rehabilitation standards and the sale price to the Housing Authority. If the agreement can be made, the developer acquires the house, rebuilds the interior and then sells the house to the Housing Authority. The typical house is a one-family, 2-story, 3-bedroom home which is sold to the Authority for no more than $12,300. In most cases, the developer attempts to buy the house at $2,500 or less and rebuilds it for approximately another $9,000. The balance of the cost involves the two settlements and miscellaneous costs. This program can accomplish numerous objectives in Philadelphia; two most important ones are the scattering of public housing occupants throughout existing neighborhoods, and rehabilitating derelict houses.

The fifth program is the newest in our comprehensive approach to residential rehabilitation. This program is known as Federally-aided Code Enforcement. Several areas of the city are delineated as code concentration areas and are now being inspected for housing violations. After each house is surveyed, rehabilitation specialists from the Department of Licenses and Inspections will work with those property owners who have expressed an interest in obtaining financial assistance through Sections 115 or 312 of the Housing Act. The Philadelphia Redevelopment Authority has agreed to cooperate with the city to the extent that the Authority will provide its financial know-how by taking referrals from the rehabilitation specialists. These referrals include a work write-up and contractor's bid. The Authority will then process this data through the Department of Housing and Urban Development to obtain the requested grant or loan.

The particular program envisions approximately a 24,000 property workload. In the areas in which it is permitted to operate by federal law, it is expected to be a success.

The rehabilitation program which is most comprehensive in its approach, but yet limited to a specific project area, is the Redevelopment Authority's Conservation-Rehabilitation Program. The Authority's program is divided into three categories, or oriented towards three distinct goals. One area is a complete change of neighborhood character and involves a restoration program; this is the area of "Old Philadelphia" known as Washington Square East, or better known in Philadelphia as Society Hill.

A second area surrounds the magnet of the University of Pennsylvania and Drexel Institute of Technology. These are non-assisted projects. In our renewal language this means that there are no federal funds available for clearance.

The third is the one in which the city has put most of its effort and funds. They are the "gray" residential neighborhoods. The Authority does not have a comprehensive rehabilitation program for the slum areas of Philadelphia. Such a program is evolving through the Model City plan.

Conservation Neighborhoods

There are seven gray area conservation neighborhoods. Each area encompasses approximately 200 acres and 2500 homes. The city, through the Authority, has committed itself to spend millions of dollars in an attempt to conserve those aspects of the neighborhoods that are conducive to the residential character, and through clearance to eliminate deficiencies.

The Redevelopment Authority as a practice opens a field office at the earliest stages of planning. A professional Community Relations Representative and clerical staff are assigned to a field office to work with any existing community organization. Through the two or three year planning stage all aspects of community development including residential rehabilitation will be discussed and worked upon by the area residents.

By the time we are prepared to implement the plan, we have made a complete survey of each home, listing code and rehabilitation deficiencies, and are prepared to start our selling program to encourage the homeowners to make the needed repairs.

In 1966 and the first four months of 1967, we have been provided with an added incentive to sell rehabilitation. This assistance is in the form of Section 115 and 312 rehabilitation grants and loans provided by the federal government. In this 16 month period, Philadelphia received approvals of $1,313,823.00 which involve 564 grants and 117 loans. These funds represent approximately one-third of the total monies that have been spent in the gray neighborhood areas.

The caliber of success we are achieving with the assistance of this financial grant and loan could not possibly be attained by private borrowing or saving. These funds have not only helped us in working with homeowners to rehabilitate their houses, but have also served as a valuable community relations tool, as we are now in a position to show the residents that we have a means of taking care of the elderly homeowner and the family who cannot borrow in the private market.

Our program in Philadelphia is a voluntary rehabilitation program with the threat of code enforcement being used only as a last resort. In 1966 over 600 houses in these areas were rehabilitated by the residents. We consider this an excellent start but it is by no means a satisfactory optimum.

In each field office our seven or eight rehabilitation specialists act as the salesmen and work with the homeowner in selecting a contractor and preparing a work write-up. They then refer the cases to our financial specialists who are skilled in real estate and mortgage matters. In those difficult blocks where there is reluctance to rehabilitate, our community relations representative has the responsibility of breaking the ice in order to get rehabilitation under way.

It will take another year before we can determine whether we have been successful, but it is obvious that a program that is involving $3.5 million in rehabilitation which was never spent before in these gray area neighborhoods is a major step towards maintaining a decent, safe and standard home.

The most important point for consideration is that the various agencies, corporations and lending institutions must cooperate to make this program a success. There is not enough time in the actual practice of community development to debate which sector of the economy, public or private, has the responsibility and skill for carrying out residential rehabilitation.

Assumptions based upon our experience in Philadelphia are that rehabilitation projects without consideration for renewing the neighborhood have questionable merit. We have also found that comprehensive renewal programs in a delineated area do not constructively affect other sections to any significant degree. In other words, the analogy of a pebble thrown into a pond creating a ripple is not substantiated by our experience.

The residential rehabilitation attack needs everybody who is interested in repairing one home. But, for those of us who belong to agencies or corporations who are considering a much bigger challenge, we are faced immediately with a fantastic number of related problems similar to a developer of a large subdivision or a new town.

With the understanding that the changes that we are creating become part of our responsibility, Philadelphia through private, quasi-public and public interests has started to rehabilitate thousands of homes, realizing that the solution is difficult to achieve and that many of the by-products of both problems and achievements are still unknown. ☐

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Rehabilitation in Chicago

CHICAGO DWELLINGS ASSOCIATION is a quasi-public housing agency of the City of Chicago. It is a non-profit corporation engaged in an extensive program of rehabilitating middle-aged apartment buildings, as well as constructing new ones.

This extensive program was initiated in 1965. Very simply, here is how we operate. We obtain possession of a building, either through receivership from the courts, or ownership through purchase. As an example, take a typical receivership building originally designed as a 6 flat or 12 or 18 flat. The first visit usually reveals a dilapidated entry, vandalized mail boxes, overcrowding, broken plumbing, exposed wiring, leaking roofs, deteriorated back stairs, cracked landings, broken plaster, rodents and insects; and a smell, a very unpleasant smell.

Our first job is to ascertain the work necessary to bring the building up to code. This involves the creation of plans and specifications. With this information and a cost estimate based on bids, we present our recommendations to the court. If the court agrees, we then proceed, first, to relocate the families, and then go ahead with the work. This involves delay after delay in the courts. The owner, you see, will not get any income from his property until we amortize the total cost of rehabilitation. This is done through issuance of receivership certificates, which are sold at present to our sister agency, the Chicago Housing Authority.

The Chicago Housing Authority uses State Housing Grant Funds for this purpose. Eventually, after a test case is decided in our favor, we anticipate selling these certificates to banks and insurance companies.

Once we receive the consent of the court to proceed with the work, we are faced with the monumental task of relocating these families, which are often large, fatherless, and on welfare. This can take weeks or even months, despite using the relocation services of the Department of Urban Renewal.

Beginning the Work

Now we are ready to start the actual work. You must remember, however, we are authorized to rehabilitate this building only up to code. This means the minimum standards for refurbishment. We often have to overlook aesthetic changes we would like to incorporate in bringing the building back to better condition. From a long range point of view, this may prove to be short sighted, because our amortization period averages 8 to 10 years. But at the moment, this is all we can do.

Not all rehabilitation under receivership is carried out by the CDA. The CRF and MF also do some of this work. Very often the owner will state in court that he is ready to carry out the work. At that time the court frequently permits the owner to proceed, but

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IRA J. BACH, Executive Director, Chicago Dwellings Association, Chicago, Illinois.

requires CDA to remain as receiver to supervise the work. We have done this with over 100 buildings containing about 1200 dwelling units.

In spite of this, as you will see from our figures, we have saved several thousand dwelling units from further blight and by so doing, have helped some neighborhoods to be restored to a better living environment.

An important aspect of all this is rehabilitation through acquisition and ownership. We have three methods of carrying this out. First is the "Chicago Plan." This is the accelerated method of carrying out an FHA 221 (d) (3) program.

In May 1966, our Mayor, Richard J. Daley, and Secretary Robert C. Weaver approved this plan created specifically to facilitate the CDA program. Under the plan, CHA delegates full authority to CDA to select properties for rehabilitation. CDA may also determine the cost and the extent of rehabilitation in accordance with FHA minimum property standards. FHA allocated $3 million for the first year of a three-year program. To facilitate the success of this program, the Chicago Housing Authority agreed to acquire title and pay for the properties and then convey them to CDA. It further guaranteed the payment of FHA-insured mortgages by CDA. We have selected four areas of Chicago for this portion of our program.

The Lawndale Project

One example is Lawndale, a vast, overcrowded blighted area on the west side of Chicago. Here, we have a two-block section facing a boulevard, near parks and schools and excellent transportation. The area consists of low-income Negroes. The two-block area contains 152 dwelling units. Under the Chicago Plan, we carried out all the preliminary work prior to submittal to FHA. This included surveys, architectural plans and specifications, appraisals and contractors bids, as well as options to purchase.

Upon approval by FHA, we then proceeded with the purchase, relocation of families, and construction work. The CHA is carrying out the construction work for us in all the buildings in the two blocks in Lawndale, using its own technical and maintenance staff for this purpose.

The second kind of ownership acquisition is the purchase of buildings under an ownership program, using the ordinary FHA 221 (d) (3). This takes up much more time than the Chicago Plan. Sometimes months ensue before approval is obtained from FHA. However, the advantage of this plan, is that financing is 100 percent through an insured mortgage, whereas, under the Chicago Plan, the preliminary technical engineering work by our staff, or consultants, amounts to approximately 20 percent of the cost. We prefer using the Chicago Plan as long as our local funds last.

The third ownership method is to carry out rehabilitation through the use of conventional mortgages. This is done through local banks or insurance companies. In all three methods, we finance the construction work wherever possible, through interim financing. This is done through banks and savings and loan associations.

As of January 31, 1967, CDA was appointed receiver of 309 buildings consisting of 3225 dwelling units. Of that number, 174 buildings with 1944 dwelling units were discharged by the court. This left CDA as of that date with an active work load of 135 buildings containing 1281 dwelling units.

Code compliance had been achieved by 102 buildings with a total of 1130 dwelling units. This code compliance had come either through rehabilitation by CDA or rehabilitation by the owner, at which time the court empowered CDA to stand by and complete the owner's rehabilitation if necessary. Another 63 buildings, with 520 dwelling units, were declared unfeasible for rehabilitation and the court ordered them demolished.

The 1960 census indicated that by 1965, Chicago would have approximately one-half million apartment units at least 50 years old. This has turned out to be a conservative figure, so the task with which we are faced is formidable. Our work in these buildings often calls for new wiring throughout, new kitchen and bathroom fixtures, new heating plants as well as a considerable amount of new plastering and flooring. Window sashes are often replaced along with the roofing. The exterior of the buildings are steam cleaned and the front and rear yards landscaped. The mortgages in most instances will be for 40 years and for that reason most of the fixtures and all equipment have had to be replaced.

We know we cannot do all the work that has to be done, but by selecting one or two block areas and thus concentrating our efforts, at least we can make some impact and hope to inspire surrounding property owners to follow suit. Or we do spot rehabilitation in a generally stable area, designed to keep the area from further or rapid deterioration.

To do the work within the cost limitations and attempt to serve the families within the moderate-income bracket is another major problem, because middle-aged buildings require extensive renovation. This costs a lot of money, and when we are through, the rents have to go up. The big problem here is how to continue to serve the same income bracket. In spite of the FHA low interest rate and 40 year amortization, the cost is still high. Exclusive of acquisition, our costs average about $6,500 per dwelling unit for a five room apartment. Some sort of subsidy is necessary if we are to serve the same families. Rent Supplement and Public Housing Leasing Programs help some of the people, but not nearly enough.

Proposals

As a result of 25 years of trying to improve living conditions for low income families through many approaches—public housing, slum clearance, urban renewal, city planning and now rehabilitation—I should like to make the following proposals:

1. Non-profit corporations should be assisted in rehabilitation work beyond what the present FHA 221 (d) (3) program permits. There should be a fed-

eral grant available for the purchase price of the building. By eliminating the capital cost involved in rehabilitation work, lower rents or lower sales prices can be achieved. These figures can then meet the demands of low-income families. Cooperatives and condominium sales can be made available. In effect, a one-time subsidy of this type can be the difference between success and failure in obtaining decent housing for the poor and moderate income families.

2. A comprehensive planning approach in rehabilitation should be encouraged, especially in the new model cities program. By planning one or two whole city blocks at a time, rehabilitation can make a much greater impact on the surrounding neighborhood. Federal aid for vacating alleys and garages, to be replaced by green spaces, play areas and parking compounds would be a tremendous factor in assuring ultimate success.

3. FHA should be empowered to insure receivership certificates issued by non-profit corporations. Also, F.N.M.A. should be permitted to purchase these same certificates. If the interest rate is low, it would be an additional factor toward helping the poor. This would be of immense importance to most cities with building code enforcement programs.

4. A federal fund should be available to non-profit corporations to be used as revolving funds. The purchase of buildings requires equity capital to get started. The same applies to receivership buildings that also require initial funds before commencing actual work. These same funds might be used to rehabilitate receivership buildings beyond code compliance.

5. There should be state legislation to provide for lower real estate taxes for apartment buildings rehabilitated by non-profit corporations. I would suggest that 15 to 18 percent of gross income be permitted as the maximum tax for buildings of this type. This would be an additional way of assisting the low-income and moderate income groups.

6. Everyone talks about new techniques, technical advances through prefabrication or instantaneous construction work, or clearing out the insides of a building and starting from scratch. There is now available sufficient experience from these and the more conventional methods to form a basis for some dynamic technical research. Therefore, I should like to propose that the Building Research Institute apply to the Department of Housing and Urban Development for a research grant to evaluate the entire work to date and explore various untried and worthwhile new methods to bring down costs and raise standards.

Finally, the rehabilitation of older apartment buildings might be compared today to the used car market. Not everyone can afford a new car, but almost everyone needs a car. The low-income consumer has discovered that it is more economical to buy a well-built used car than a cheaply built new one. The same applies to the low-income renter or home buyer.

With today's land costs, today's construction costs, together with today's building code and labor restrictions, no one can hope to rehabilitate or construct apartment buildings cheaply enough for poor people or moderate-income people to rent or buy without some type of subsidy.

One of the wisest contributions government could make today, to make better housing available to the poor, would be to assist non-profit corporations in their efforts of rehabilitating apartment buildings. It would certainly be cheaper and less disruptive than the wholesale leveling of neighborhoods. We really have no choice but to try. ☐

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Rehabilitation in Kansas City

REHABILITATION CAN ONLY BE ACCOMPLISHED by close, continuous association, with the shedding of some blood, sweat and tears. It cannot be carried out by directives handed down at arms length.

Older housing varies about as much in Kansas as anywhere else, but there is a predominance of wood frame, detached, one, two, and an occasional three story house on limited sized lots. Floor plans and exterior design are often repeated, but seldom are there two alike in a row. This random pattern defies a standard rehabilitation solution, universally applicable.

Our older housing ranges from the large family home, currently cut up into several marginal apartments, to the small, makeshift, three room "shotgun" house with the outdoor privy, to be found in abundance around the town's fringe, and now engulfed by the spreading suburbs. Inadequate original construction, built in the pre-code days, often was erected by the land settler's family or his other unskilled neighbors.

Frequent Housing Deficiencies

Most frequent housing deficiencies have been electrical service and wiring, makeshift plumbing, weathered away or missing exterior roof and wall coverings, and foundation settlement caused by poor limestone used in the basement walls or by hilly, unstable subsoil strata.

In Kansas City, Kansas, many of the town's original residential areas were located on the river bluffs or their hillsides overlooking the Kaw and Missouri Rivers. Original land subdivision gave little concern for the topography, with many lots inaccessible and streets which could not be negotiated to the top. Haphazard housing was to be expected in these areas of poor development, yet people did build, and demand municipal services. They received a few, but struggled along without utilities, roads and services, most of which we now consider essential. Deterioration was inevitable, and now these relatively close-in blighted areas call for change.

The Renewal Agency Rehabilitation Staff was made up of young architects, former contractors, and an ex-building inspector, all possessing a working knowledge of buildings, which was taken for granted, and that other essential ingredient, a soft-sell but persistent approach. Considering our high owner-occupancy ratio, along with a rather independent spirit toward property ownership, an educational program was devised first, and the encouragement to rehabilitation second. An understanding of urban renewal objectives and responsibilities in accomplishing rehabilitation was started with project residents by means of block meetings during the project planning period. By project approval time, most residents knew what to expect in the way of public improvements to be done by the agency or city. They knew that they were not in this thing alone, and they had a pretty good idea what they must do over the two year rehabilitation period. A few got their work started prior to Project Execution, most still took the wait-and-see attitude.

Rehabilitation Procedures

The staff used freehand sketches of practical floor plan changes and exterior improvements as a selling tool. Most residents are well aware of their structural and mechanical deficiencies, but nearly all have difficulty visualizing potential improvements. This is where the staff contractor-architect team comes up with the solutions. However, it should be understood that not all of the staff ideas get carried out. Property owners often have very strong preferences, but at least some orderly ideas and seeds of aesthetics are planted and we like to feel that the percentage of acceptance makes the effort worthwhile. Several exterior color schemes are included in the sales package along with the itemized list of structural and mechanical deficiencies. Motivation of an owner by some fresh ideas, a friendly and knowledgeable staff willing to assist, and a means

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to finance the work provide the start for another rehabilitation job. The physical repair work is a mechanical job to be cranked out, even by the traditional small contractor methods we in the Midwest seem to be saddled with.

An owner may have the desire, but unless he is assured that the rest of the neighborhood is coming along, he will hold back.

Modernizing of public facilities, including sidewalk replacement or repair, storm drainage systems capable of meeting the need, alley paving, and street lighting, among others, are the city's responsibility. All of this adds up to adequate and wise project planning to start with. Then, proper sequence and timing as each activity is carried out keeps the process orderly.

While the Midwest has some semblance of a rehabilitation industry, many cities such as Kansas City, Kansas, still carry out the majority of their remodeling and rehabilitation by independent mechanics and small contractors. Do-it-yourselfers, assisted by a brother-in-law, still account for much of the non-licensed trade work, general painting, and carpentry. We found several small contractors interested in urban renewal rehabilitation work who are now regularly completing jobs financed by those two welcome programs, rehabilitation loans, and grants. The Congress saved the struggling rehabilitation concept in 1965 with these two financing programs. At best, urban renewal rehabilitation was hit-and-miss before the loans and grants. Now, compliance with all rehabilitation standards can be achieved with no more owner alibis.

One measure of the worth of neighborhood rehabilitation has been demonstrated by local banks and Saving and Loan Associations lending on new modest homes constructed on spot-cleared lots in an older rehabilitated neighborhood. Kansas City has had many examples of this, undoubtedly made possible by the upgraded surroundings, LPA clearance of the former dilapidated structures, a realistic price tag on the cleared lot, and the lender's being convinced that a stable neighborhood value has been established. We think this is a positive step toward future natural regeneration now that new homes are intermingling among the older rehabilitated ones.

Obtaining Compliance

Obtaining 100 percent compliance with Project Rehabilitation Standards is a difficult task. Most owners will see the necessity and come along on this "voluntary program," but a good many refuse or have a hundred excuses to delay, or want to do it only half way. Kansas City had a housing code as well as a non-residential code, all applicable to existing structures. These, backed up by electrical and plumbing codes, gave the LPA all the leverage needed for those sound and economically feasible properties having reluctant owners. Occasionally, however, properties scheduled to remain for rehabilitation just cannot measure up to economic feasibility, or conditions have changed which make rehabilitation unrealistic. What is the answer here? One solution is for the renewal budget officer to have a financial reserve and be prepared to buy this property, clear it, and resell it for redevelopment, or make a "vest pocket" or parklet open space.

Not to be overlooked in older residential areas are their industrial centers of employment and shopping areas. Also, the school, community center, branch library, churches and other semi-public institutions are an important part of the rehabilitation picture which cannot be overlooked, for we must tackle the whole neighborhood organism if we are to improve any one part.

Commercial Rehabilitation

In one situation, a six block long neighborhood shopping district called for about half of the old houses and store buildings to be cleared, particularly the wooden frame structures, the obsolete narrow stores, and the still remaining houses mixed in with the stores, some with store fronts tacked on. The remaining sound but rather nondescript masonry commercial structures were left and scheduled for rehabilitation. The Urban Renewal Plan called for assembly of three good-sized redevelopment parcels, to be accomplished by vacating three sections of old streets and combining lands cleared of dilapidated structures. Creation of seven off-street parking lots were planned to accommodate customers of the rehabilitated buildings, which previously had no parking at all. Sketch ideas for store modernization, new store fronts, some unifying features, and attractive rear entrances were prepared. The public project improvements included paved service alleys, widened streets, and curb repairs and replacement. The redevelopment sites turned out to be the key. A new bank, new post office, medical clinic and a multi-tenant shopping center structure quickly took advantage of the potential. Two small decorative and landscaped midblock parklets were provided and now serve as pedestrian walkways from parking lots to the shopping street.

This is commercial rehabilitation in the broadest sense. True, the remaining stores scheduled for rehabilitation were slow to start, reluctant to spend extra money beyond barely meeting the rehabilitation standards, but the burst of adjacent redevelopment activity and the upgraded surrounding residential area made them see the potential.

A run-down commercial district does nothing for a residential neighborhood trying to rehabilitate or being required to upgrade by renewal or code enforcement. The converse is also true. Why should businessmen invest in better facilities and merchandising when surrounded by the same old blighted residential areas? The answer in this case is in a well-conceived total rehabilitation approach for both, coupled with public improvements. ☐

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Financing Rehabilitation Through Federal Housing Acts

FOR OVER FIVE YEARS, FHA has been wrestling with this great, and up to now, largely intractable problem of massive rehabilitation. We have searched far and wide for the magic key which will unlock the mystery, for the pick which will penetrate the enigma of residential rehabilitation. We have been deeply involved in experiments to find out how to apply our mortgage insurance programs to urban renewal rehabilitation in Baltimore, in Cincinnati, in Boston, in St. Louis, and in other places. These efforts have led to many significant changes in FHA policy and procedures and an intimate cooperation with local public agencies in support of their efforts.

We have tried hard to gain insight into the rehabilitation process and sharpen the tools. If words alone were enough, the problem would be solved. In the past few years FHA has literally deluged those willing to read and listen with pamphlets, essays, books, and speeches on the subject of rehabilitation. But words alone are not enough. We need deeds.

The Major Obstacles

Our experience suggests several principal obstacles yet to be overcome:

1. We need to generate a massive market for the rehabilitation of run-down houses in run-down neighborhoods. Unless the demand is there we can hardly expect private industry to respond, as they must. Because of the nature of the problem, government has to play a large role in generating that market. Many of the people living in the areas most needing rehabilitation simply cannot afford the cost, or required rent, of bringing their dwelling units up to a decent standard. In a very large number of cases the cost of acquiring run-down properties, plus the cost of rehabilitation, when financed on conventional terms and at market interest rates, require monthly payments out of the reach of the families we are trying to help. This means that the government must bring the cost of rehabilitation within the means of the low income residents of substandard housing by favorable financing, or outright subsidy. Among the tools presently available for accomplishing this objective are long-term loans at below-market interest rates, rent supplements, land write-down through urban renewal, and leasing or purchase of rehabilitated structures through public housing.

2. We need to carry out rehabilitation on a far more massive scale than has been achieved so far. Up until now even the most successful rehabilitation has been a slow and tedious process. We need to carry it out on a massive scale and with speed. This is the only way we will make a true and lasting impact on a run-down area. We need to create a massive and decisive reversal of the many forces—economic, social, and political—which are now converging to reinforce and accelerate the cancerous process of neighborhood decay. The job must be done in a big way if we are to erase the misery and despair of the slum dweller, give him confidence and a reason to hope. There is a close correlation between the living conditions described and the riots which have broken out in so many of our great cities. And the mayors of these cities know this.

Massive rehabilitation is also necessary if we are to achieve much-needed economies of scale. The house by house approach to rehabilitation has made it inevitable that the process would be inefficient and the rehabilitator small, marginal, and unskilled. If we are to attract large and efficient contractors into rehabilitation, we must do the job on a massive scale.

3. We need to combine physical and human rehabilitation, for the people where they live, in a way rarely accomplished to date. When the objective is to remove blight and eliminate the slum condition, we learned long

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ago that physical improvement alone is not enough. If you improve the house without doing anything for the poor people who live in it, the chances are great that the decay, neglect, and disrepair will reappear in a few years. As a representative of the U.S. Gypsum Company has said: "In our rehabilitation efforts in New York, we learned very quickly that 'people is the name of the game!'" Physical renewal must go hand in hand with human renewal. Of the two, human renewal is probably the more vital. However, physical renewal through rehabilitation provides a tangible, dramatic focus around which to array the processes of human renewal. Physical improvement is something the residents can see, and feel, and touch. It can become the symbol of improvement, pride and hope, and make them more receptive to the efforts to help them improve their housekeeping, their respect for property, their skills, their employability, and capacity to move upward socially and economically.

4. We need to generate a rehabilitation industry. At the present nothing exists which could properly be called a rehabilitation industry. What rehabilitation has been done has, for the most part, been carried out by small, poorly financed, unskilled contractors or subcontractors. And even these are hard to find in many cities. In short, the much praised skills, ingenuity, energy, inventiveness and management genius of American industry are not now being applied to this vital task. Things will start happening in the rehabilitation field only when private industry moves in in a big way. It is the government's job to see that a sufficiently large market for rehabilitation is generated to stimulate and make profitable the development of a rehabilitation industry.

5. We need to apply technology and systems engineering to make the rehabilitation process faster and less costly. If the process of homebuilding is primitive, as many have observed, the processes used in rehabilitation are much more antiquated and inefficient. We need to develop new devices for diagnosing what needs to be done to an old building and for accurately estimating costs; we need to develop new tools, new methods, new materials and equipment, and new systems for applying all of these elements to neighborhood upgrading in an efficient and speedy way. The U.S. Gypsum Company has made a beginning on this in its rehabilitation work in New York and other places. Other large companies are involved or are about to become involved, too. The "instant rehabilitation" which has just been successfully completed in New York by Conrad Engineers, a private foundation, and HUD is suggestive of the many possibilities which exist for improving rehabilitation technology if the right brains are applied to the task.

What Kind of Loan Processing?

The FHA manual as it applies to rehabilitation has to be rewritten. The traditional approaches which apply quite well to new construction will not work for rehabilitation. In our efforts in urban renewal areas, FHA has already rewritten the book. We developed new and more realistic physical standards for rehabilitation. We developed new approaches to loan processing. We developed new approaches for relating loan processing with the servicing and counselling of property owners carried out by the local renewal agency. We are now engaged in preparing a brand new FHA rehabilitation manual for multifamily rehabilitation under the Section 221 (d) (3) below market program and the rent supplement program.*

While this work is still under way and no final decisions have been made, several approaches are recommended which are crucial to effective processing of FHA-insured rehabilitation loans.

1. *Flexibility in judging the acceptability of a neighborhood.* FHA will, of course, insure rehabilitation loans in urban renewal areas. For here the city is committed to taking the actions such as public improvements, creation of open spaces, rehabilitation and rebuilding, and neighborhood organization, which are needed to upgrade the neighborhood. But FHA is also willing to insure loans for rehabilitation, and property transfer, outside of urban renewal areas, if the proposed public or private actions, or a combination of both, give reasonable promise that the neighborhood improvement will be permanent and the improved values stable. While we do not think that rehabilitating one house in a sea of slum structures gives much promise of stable improvement, we do believe that rehabilitation of a group of structures, when combined with the necessary social action, is worth undertaking.

In a number of cities, outside of renewal areas, FHA has insured mortgages for rehabilitation involving the structures on a single block, and in some cases, even less than a full block. Each situation must be judged separately. Much depends on location, the structures involved, the incomes and attitudes of the residents, whether the structures to be improved are contiguous, and the willingness and capacity of the city or the private group to communicate with and give human services to the residents.

2. *Pre-application feasibility analysis.* In rehabilitation projects, we have found it essential to establish, in general terms, the feasibility of the undertaking before the properties are acquired, although it is sometimes necessary to secure options to purchase the properties in order to gain access for the necessary inspections.

The factors to be considered in the feasibility review are the cost of acquiring the properties, the level of rehabilitation to be undertaken, which must be identified in specifics, the estimated cost of rehabilitation, the appropriate term of the loan, financing and other incidental costs, and the rent paying ability of the residents. An analysis of these factors, which should be carried out jointly by the FHA, the sponsor, and his architect and contractor, will make it possible to determine whether the arithmetic works out, that is, whether it is possible to acquire and rehabilitate to the agreed level at gross rents within the paying ability of the residents to be served. An early, and careful, joint feasibility review will make it possible to determine which buildings can be rehabilitated and which cannot, as well as how much the sponsor can afford to pay for the properties. It also saves much time, effort, and money.

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* *A new FHA manual for processing multifamily rehabilitation applications, embodying the principles discussed here, was issued in December, 1967.*

3. *Contingencies.* In the present state of the rehabilitation art, it is almost inevitable that, even with the most conscientious inspections, work write-ups, and cost estimates, the ultimate cost of rehabilitation will turn out to be greater than anticipated. This comes from the fact that rehabilitation cost estimating is a highly inexact art because, among other things, it is difficult to determine in advance all the work that needs to be done. Thus, the mortgage commitment as well as the feasibility determination should recognize and reflect these cost contingencies. The FHA commitment should include a reasonable amount to cover construction contingencies without change orders or excessive red tape.

4. *As-is value of the property.* Under FHA programs the amount of a rehabilitation mortgage is based on the as-is value of the property plus the cost of rehabilitation, plus normal financing charges. As we have seen, the as-is value of the property is crucial to the feasibility of the undertaking. If it is too high, the proposed rehabilitation will not be feasible because the required rents will exceed the incomes of the people to be served. Thus, the amount that can be paid for the property can be arrived at by working backward from the rent paying ability of the residents. When rent paying ability is known this can be converted into the mortgage amount which can be supported by this rent, with a given term and interest rate. Subtract the estimated cost of rehabilitation plus financing charges from the maximum mortgage which can be paid for the property. This is the amount the sponsor can pay for the property and this is what FHA should recognize as "as-is" value in its mortgage calculations.

This "residual" approach to the as-is value of properties for rehabilitation is capable of being turned into a perfectly respectable appraisal theory for setting value on properties designed to be rehabilitated for low and moderate income families. It formulates thus: As-is value of properties to be rehabilitated for low and moderate income families is the amount which a prudent investor would be justified in paying for the property, given the rehabilitation to be carried out, the market to be served, and the financing programs available.

5. *Economic life.* FHA has traditionally followed the rule that the term of a rehabilitation mortgage should not exceed three-quarters of its estimate of the economic life of the structure after rehabilitation. In many cases, the mortgage term which can be allowed is crucial to the feasibility of the undertaking, because mortgage payments are reduced as the term of the mortgage is extended. In not a few cases, this formula for establishing the mortgage term has seriously impeded FHA's ability to allow a term sufficiently long to make rehabilitation for low and moderate income families feasible.

We need to develop a more realistic method for establishing the mortgage term that is appropriate for rehabilitation financing. The key term in the traditional formula is inexact and unreliable. It is difficult, if not impossible, to predict accurately the remaining life of a residential structure. Much depends on such unknowns as the quality of maintenance provided by the owner, the shifting pattern of urban land uses, and many other factors. An appraiser trying to predict the economic life of Mount Vernon in 1800 would probably have erred by at least 100 years. The same can be said for many residential buildings in Washington's Georgetown. On the other hand, the life of many dwellings has been abnormally shortened by public taking for roads, highways, and other purposes. The natural forces of the market often foreshorten the life of a residential structure when it gives way to high rise apartments, office buildings, and other more profitable uses.

In judging the term which can be soundly permitted on a rehabilitation mortgage, the key determination is not how long that building will remain in residential use, or how long it will last physically; but how a reasonable projection of the value of the site or the building relates over a term of years with the mortgage debt which will be against it. At the root of this approach is the thesis that in a rapidly urbanizing society, land, as land, near the heart of a city, is unlikely to diminish in value over the years and very likely to increase in value whether the future use be for housing or some other purpose. Thus, there is no reason why a 30-year mortgage could not be safely placed on a rehabilitated structure, if at the end of 15 years, there is a reasonable basis for assuming that the value of the land at that time will equal or exceed the mortgage debt which remains. Our judgments on the mortgage term appropriate for residential rehabilitation should be based on a consideration of these realities.

6. *Speed of processing.* FHA needs to find ways to speed up its processing of multifamily rehabilitation applications if it is to stimulate and support a massive rehabilitation effort. This is fully recognized by Assistant Secretary-Commissioner Brownstein. Indeed, he has directed top priority attention to be given to the development of speedier processing in all of FHA's multifamily programs. It is believed that he will find ways to achieve this much needed, and long sought, objective. ☐

Mr. McFarland is a member of the American Economics Association, and he holds that organization's Distinguished Service Award. He received his Ph.B. from Spring Hill College and his M.A. and Ph.D. in Economics from Georgetown University.

Financial Aspects of Rehabilitation

WHENEVER CONSTRUCTION OR REHABILITATION of real estate is involved, two distinct and completely separate types of financing are required: short-term for construction and long-term thereafter. As a mortgage banker, I not only rely on two sources of money, but make my financing arrangement in reverse chronological order. I first arrange for the so-called permanent mortgage, that written for a term of 15 or 20 years. But this mortgage only comes into being after a building has been rehabilitated, and "interim" or construction money is needed first. Unlike the permanent mortgage amount which is received in one lump sum, the interim money is paid out periodically during the course of rehabilitation. Essentially it is a short-term loan, to be replaced by the permanent loan when rehabilitation is completed.

Occasionally the same lender will supply both the interim money and the end mortgage, but more often a bank furnishes the former and an insurance company furnishes the latter.

The first money we will actually require is construction money. To provide this, a major mortgage banker will not only have funds of his own, but extensive lines of credit at a number of the largest banks in his community. The bank looks first to the reliability of the mortgage banker, and second, to the commitment some permanent lender had made, to replace the interim funds. Let us be clear then, that rehabilitation involves two distinct types of mutually dependent financing, and that a commitment on the second type is a prerequisite for obtaining the first. The point is that a permanent loan without the availability of an interim loan is valueless. In our recent past, we have seen projects held up simply because construction money was not readily available.

Conventional Loan vs FHA-Insured Loan

Now let us explore our operation in the typical case of a conventional loan as distinguished from an FHA-insured loan. If first I list some of the criteria which an experienced lender of permanent funds will apply to a building that requires rehabilitation in an economically desirable area, you will begin to sense the particular problems we encounter in less attractive areas where the most serious rehabilitation is urgently required.

The lender looks to the location. He asks: Is the area generally stable and desirable? Are the property owners maintaining their buildings in first-rate condition?

But most important, what net income remains after operating expenses, and what net income will become available after the building is rehabilitated? What is the present or "as is" value of the building and what will be its value when the necessary rehabilitation has been accomplished?

These are only a few of the questions. If the answers are satisfactory, we should get a commitment. But for how much money, at what rate of interest, and for how many years?

On a conventional basis, major lenders like to hold a first mortgage investment to ⅔ the value of the property, and cost of acquisition and rehabilitation is only a physical test of value. Far more important is the economic value arrived at by capitalizing net income. It is ⅔ of this economic value which largely controls lenders.

The rate of interest will normally have some relationship to the prime rate. If prime is 5½ percent, other rates may be between 6¼ and 6¾ percent.

Finally, the term of years. Where rehabilitation is involved, 20 years would be considered a long period for the conventional lender.

The next matter is a little technical but extremely important. We said that the net income was a very significant figure since it is out of this net income that the owner will make his annual payments of principal and interest, payments we refer to as "the debt service."

ALVIN ZELITZKY, Vice President, Salk, Ward & Salk, Inc., Chicago, Illinois.

Mortgage bankers speak of a debt service constant. This is a shorthand way of expressing, in terms of a ratio or percentage, the relationship between the amount of debt service and the amount of the original mortgage. As an example: Assume a $1,000,000 mortgage on a building with a mortgage repayment of $90,000. The ratio between $90,000 and $1,000,000 is 9 percent or what we would refer to as 9 constant.

A 15-year loan to be amortized with a constant under 9 would have to be coupled with an interest rate of 4⅛ percent. No such conventional loan rate being available, our owner cannot accept a 15-year term. How about 20 years? To stay under a 9 constant, we must couple the 20-year term with a rate not above 6½ percent. Note the effect of the additional years in helping us stay within the money available.

The constant on a 6 percent loan for 20 years is 8.6. But the constant on a 6 percent loan for 40 years is 6.61. Accordingly, if in our given case there were only $66,000 available for debt service, a 40-year term would be indispensable. If a 20-year term were the best available, it could work only if coupled with a 3 percent interest rate. But do you see any likelihood that a conventional lender who refuses to go beyond 20 years would soften the blow by offering an interest rate so far below the market?

From this illustration we can learn two lessons: First, that several different combinations of interest rates and terms of years can produce the same constant. Once we know the amount of money available for debt service, we can interpret that amount in terms of a constant, and search our tables for the various combinations of interest rates and terms of years which will qualify. The second conclusion is that the term of the loan, the amortization period, is every bit as important as the interest rate. Very often, it is far more important. Indeed, the tremendous advantage of the FHA insurance program is the possibility of a 30 or 40-year amortization. With this liberal repayment period it becomes possible to support a debt service which would otherwise be out of the question.

One additional fact is the critical nature of the net income figure. First, it is out of the net income that the owner must find the money to pay his debt service. Whatever remains is his profit on the investment he has made. Second, the value of his investment is closely tied to that net income. By capitalizing net income we determine economic value. Thus, if I tell you that I have a savings account paying me $400 per year and you know that the current interest rate is 4 percent, you can assert with some confidence that my investment is worth $10,000. You simply capitalize the income at 4 percent to determine this. We use a much higher cap rate for real estate, of course, but the process is similar and emphasizes again that net income is all-important. There is this added significance: If the cost of rehabilitation is so high that it will create a debt which we cannot handle out of net income, we are stopped right there.

Let us look at a typical rehabilitation case handled in a conventional manner. Assume a building containing 50 units, both one and two bedrooms, with a gross income of $60,000 and a purchase price of $220,000, a value we shall assume to be legitimate. The net income is $24,000. Rehabilitating the building will cost about $4,000 per unit, or $200,000. Total investment required: $220,000 to buy and $200,000 to rehabilitate, total $420,000. After rehabilitation, the gross income will be $66,000 instead of $60,000, and the net income will be $28,000 instead of $24,000. The economic value, however, may be only $300,000 and this despite the $420,000 total cost of acquisition and rehabilitation. Why? Remember what I said about the controlling influence of net income.

If the buyer can borrow ⅔ of this $300,000 economic value, or $200,000, he will have to invest $220,000. His $200,000 loan at 6½ percent, 20 years, has a $17,900 debt service. He will have left, after debt service, about $10,000. His return on investment will be less than 5 percent. Since he could put his money in a savings account and get his return, he will obviously reject the entire idea of purchase and rehabilitation. You see then how rehabilitation can be halted by pure economics, quite without considering the very strong reluctance of lenders to invest in that type of higher risk area which most urgently needs rehabilitation.

FHA-Insured Loan

Consider now the financing economics of this same proposal under 221(d)(3) or (d)(4).

The investor can borrow 90 percent of his acquisition cost and 90 percent of rehabilitation cost as against only ⅔ of value after rehabilitation conventionally. Now his investment is $42,000 and his loan is $378,000.

Under the 221(d)(3) Limited Dividend approach, a 30-year, 3 percent mortgage would cost only $19,127 in annual debt service, an amount easily paid out of his $28,000 net income. In fact, even without the modest rent increase that we assumed, he could still make out.

Under 221(d)(4) he might still obtain a 30-year mortgage, but only at 6 percent plus ½ percent mortgage insurance premium resulting in a debt service of $31,034. This exceeds the available $28,000 net income, of course, and returns us to 221(d)(3). I might add that 30 years is more generally used by FHA for rehabilitation and the 40-year term is usually reserved for new construction. In our illustration, however, even a 40-year term would not enable us to stay within our $28,000 net income under 221(d)(4), unless the sponsor would supply a greater equity.

At this point, you may be persuaded that in the most serious rehabilitation cases, the FHA program is indispensable. I think that is largely true, and I turn now to an examination of FHA. How does FHA policy work in relation to financing and is it as effective as it might be?

This discussion of multifamily rehabilitation concerns only two programs, 221(d)(3) and (d)(4). But both multifamily rehabilitation, as such, and these provisions in particular, are extremely significant.

The time factor is important in FHA policy. Certainly the amount of time involved in preliminary paper work has a direct bearing on our financing. The permanent lender asks when he can expect delivery of the loan. The interim lender asks when I expect to make my first draw. The borrower asks what the interest rate will be on the interim funds.

My answer in each case depends more on the FHA time schedule than on any other one factor. If the pace in the local office is unhurried, if the office is short on personnel, if decision making is uncertain, if repeated referral to Washington is required, if Washington compounds all this, time passes. To many prospective sponsors, the only thing they closely associate with an FHA multifamily project is the passage of time, days, weeks, months, sometimes years. This is even more true in the case of rehabilitation than in the case of new construction.

With the money market increasingly volatile, my ability to answer the lenders and the borrowers is impaired. The only thing I can be certain of is that each delay will add to the ultimate cost and reduce the likelihood that the sponsor of the first project will ever undertake a second.

But what about policy matters aside from time?

The FHA fee for the man who will do the actual work, the contractor, is no greater on rehabilitation than on new construction. But any contractor knows that the risks are far greater. Who knows what hidden problems may be disclosed once the work begins? An experienced contractor does one of two things: Avoids rehabilitation like the plague, or bids high enough to cover contingencies. Either way, the rehabilitation effort suffers. Even worse, the risks and costs are much higher in proportion when the job is smaller. Result in the case of the smaller job, the rehabilitation under $500,000: the bids are higher and the bidders fewer. In other words, FHA provides the least incentive precisely where the need is greatest.

This brief description is only a capsule summary of the problems of obtaining a competent contractor. Other unique problems face the architect, the sponsor and the mortgagee. In total, they most certainly prevent the rehabilitation program from being as effective as it might be and should be.

The picture is not wholly encouraging. In effect, private financing is not practicable in most cases. Further, the government program falls far short of being adequate. As a private citizen, I feel some obligation to offer suggestions.

Rehabilitation Suggestions

First, some basic policy decisions must be made. Is rehabilitation of housing a matter of some urgency in point of time, or simply a long-range program? If, as I suspect, there are strong reasons for obtaining early results, the word had better be passed.

Second, increase FHA salaries to attract and hold more professional personnel. Additionally, provide sufficient clerical personnel so that the absence of a single typist does not further compound the already notorious delays.

Third, separate the social aspects of the program from the economic in an administrative way. The former must be retained, of course, but this should be done explicitly instead of implicitly.

Fourth, once the local offices accept the message, expand the autonomy of the larger FHA offices in major cities, reduce the dependence on Washington and the regional offices, and thus reduce the further delay thereby entailed.

Fifth, introduce modern procedures into FHA processing, if necessary, by employing a management consultant firm to review present practices.

Sixth, revise the fee structures to recognize the far greater complexity of rehabilitation over new construction and the inherent disadvantages of small projects over larger.

This list is, of course, not complete. It could be expanded and detailed. We professional mortgagees who handle all types of financing could be of invaluable help if FHA would permit us to join their discussions on procedures and regulations.

Let me give a specific example: In many rehabilitation proposals there is not enough net income to support the mortgage amount necessary for acquisition, and to do a good job. Therefore, the project is usually dropped or compromises are made which satisfy nobody. However, it is quite common in certain types of conventional loans to have a balance (called a balloon) at the end of the amortization period. This balance is never more than the estimated residual value of the land. This makes many marginal loans feasible. Why could not there be some modification of the regulations to permit this in rehabilitation loans?

Let me conclude with a blunt expression of the views I hold after some years of deep involvement in the national housing and rehabilitation program. The official literature is filled with language tending to suggest that the greatest accomplishments will be achieved by stamping out profit wherever it is found. I think it wholly unrealistic to expect problems of the magnitude we face to be solved on a large scale and in a short time through major reliance on not-for-profit organizations.

We need some new direction. We need a drastic change of pace.

We need to understand that poor housing is one of the chief causes of our present social unrest. And we need to understand that the deliberate pace of the past is not suited to the needs of the present. It takes a roof to keep out rain, not a speech. It takes walls to make rooms, not triplicate forms. It takes an aggressive insistence that the only thing that counts is results.

We need, I repeat, some New Direction. ☐

Mr. Zelitzky is a member of the National Association of Housing and Redevelopment Officials, the National Association of Home Builders, and the Housing Committee of the Chicago Conference on Religion and Race. He received a B.A. from Roosevelt University.

Foundation Sponsorship of Housing Rehabilitation

THE KATE MAREMONT FOUNDATION, created in 1948 by Arnold H. Maremont, a Chicago industrialist, is concerned with less popular philanthropies, such as travel scholarships to teachers or voter registration campaigns in minority group areas.

The Foundation's rehabilitation effort, a project known as Metro North, involves five buildings on East 100th Street in Harlem, a street Mayor Lindsay has called the worst block in Manhattan. The Metro North area gets its name from Metropolitan Hospital and embraces East 96th Street to East 106th Street, from Third Avenue to the East River.

It contains a mixed population of about 20,000 Puerto Ricans, Negroes, and Italians. The project's buildings on East 100th Street are in the core of the area.

When New York City designated this area to be cleared for public housing, landlords either sold out or allowed the buildings to deteriorate, a result not unlike that which occurs in every major metropolitan area.

A group of tenants, living on East 100th Street, organized for their own self-preservation. They formed the Metro North Citizens Committee, which ultimately brought the Kate Maremont Foundation to New York as sponsors of the rehabilitation of five six-story buildings.

These buildings were known as the Teper buildings. The Committee met in these buildings and sought to achieve some unity of purpose. It took the form of keeping some semblance of cleanliness, taking their own complaints to the City, and bringing to bear whatever pressures they could to improve their plight. What finally happened has applicability for rehabilitation progress elsewhere, with a number of common elements: residents dedicated to self-improvement; institutional neighborhood forces to provide initial funds or staff time; catalyst; professional expertise.

In the case of Metro North and the rehabilitation of the buildings in question, there was clearly a group of citizens who wanted to make rehabilitation work. In every deteriorating neighborhood, there are leaders who zealously seek to improve the entire neighborhood.

As for institutional neighborhood forces, there was the Union Settlement and its Director, William Kirk; the East Harlem Protestant Parish and the Reverend Norman Eddy; the Church of the Resurrection and its Pastor, Reverend Charles Farrell; and St. Lucy's Roman Catholic Church and its Pastor, Monsignor Martorella. These helped develop the leadership among the people and encouraged and worked with them toward their objectives.

The catalyst in this activity was the Kate Maremont Foundation. The Metro North group had been organized, had been meeting, had engaged its own architects to develop its over-all plan for the area. But the Foundation became the trigger once we agreed to work with the group. We bought the buildings, began rehabilitation process using Section 221(d)(3), and entered into a rather unique relationship beyond that of landlord-tenant.

The problem of rehabilitation expertise is well known. We have tried: architect: sealed bids; combination architect-general contracting firm: negotiated bid; architect engineer firm: Foundation general contractor. None has been completely satisfactory.

The most important question to be answered regarding non-profit sponsorship is: Why should the Kate Maremont Foundation or any other non-profit group get involved?

A church in a declining neighborhood may have three reasons: Improvement of surrounding structures; provision of housing for parishioners; and ultimate equity at the expiration of the mortgage.

A foundation or a union sponsor may perhaps have the ultimate equity in mind when it decides to sponsor housing, but its primary goals should be to help stop the decline of neighborhoods in urban areas, and to provide housing which the private market is unwilling or unable to provide.

Perhaps, in our era of large and relatively inflexible government, the best reason of all is that foundations and similar non-profit organizations must and can be the cutting edge in devising new programs and experimenting with old ones. ☐

VICTOR R. DE GRAZIA, Executive Vice President, Kate Maremont Foundation, Chicago, Illinois.

Mr. de Grazia is former Executive Director of the Illinois Board of Economic Development. He attended Lake Forest College and the University of Chicago.

Industry Sponsorship of Housing Rehabilitation

STRETCHED ALONG some 100 yards of Mount Vernon Street in the Spring Garden neighborhood of North Philadelphia are three interesting locations. At 1625 Mount Vernon is a row house that contains three 3-bedroom apartments. At 1707 is a building, two row houses wide, that bears the sign, OPPORTUNITIES INDUSTRIALIZATION CENTER. At 1720 is a church building boldly labeled, ST. MATTHEW'S COMMUNITY CENTER, with "Information Services Center" in the subtitles.

Several blocks to the north, near the Temple University campus, are the offices of the North City Corporation. These locations represent part of Smith Kline & French's own private little war on poverty. This campaign involved SK&F's entry into neighborhood affairs, support of existing agencies, and specific projects.

Entry Into Neighborhood Affairs

North Philadelphia is a sprawling residential-industrial area that has been skidding for decades. National interest focused on the area when rioting occurred there in the sweltering days of August 1964.

Smith Kline & French is situated on the southern edge of North Philadelphia a few blocks from City Hall. For the past 20 years the company has been expanding its research, manufacturing, warehousing, marketing and administrative facility on this site.

Outside the company's front door is the Spring Garden neighborhood, a 20-block concentration of housing blight. Its population, numbering about 24,000, is mostly Puerto Rican and Negro, with a scattering of white. Families are crowded together in the increasingly fewer houses that have not been abandoned and boarded up. Like blighted zones in other cities, the Spring Garden area once was fashionable. The row houses, three and four stories high, were grand. But blight set in many years ago and with blight came disease, delinquency and despair.

In 1962 Smith Kline & French formalized its corporate concern for the residents of this tragic neighborhood by launching a community affairs program.

Support of Existing Agencies

Early efforts of the community affairs program centered on support of volunteer and public agencies. This was not a brand new venture. In December of 1952 the Corporation had established the Smith Kline & French Foundation, supported almost entirely by annual contributions from Smith Kline & French Laboratories. Beyond its first commitment to the field of medicine and medical sciences, the Trustees of the Foundation have carried out the belief that charity should begin at home.

ROBERT HAAKENSON, Ph.D., Community Relations Manager, Smith Kline & French Laboratories, Philadelphia, Pennsylvania.

Through the years the Foundation has supplemented employee gifts, making generous contributions to the United Fund, thereby supporting many of the volunteer agencies active in the city. In addition, during the 10-year period 1955-65, a total of more than $115,000 was given to organizations for support of the Spring Garden area.

There has been a program of civic grants. This includes awards and scholarships for the schools in the neighborhood, the Reverend William Drury's "Teen Haven," a daring enterprise where professional and volunteer staff establish a residence in the blighted neighborhood and work directly with gangs, and the Lemon Hill Day Camp of the Spring Garden Civic Association.

Thus, through the years, there has been substantial financial support of existing agencies.

SK&F Specific Projects

In 1966, after a comprehensive analysis of the neighborhood and its problems, the company decided to take a more direct part in neighborhood programs. Four examples illustrate the company's involvement.

Information Services Center. In the spring of 1966 the company established an Information Services Center with a staff of three. The purpose of the Center is to tell people in the area where they can get help when they need it, help with food and clothing, jobs, education, training, debt problems, neighborhood nuisances and other needs. The Center will have an annual budget of about $40,000.

Opportunities Industrialization Center. The SK&F Foundation was one of the early supporters of the Reverend Leon Sullivan's Opportunities Industrialization Center, a privately-supported organization offering job training. It has been so successful it is being established in many other cities. Last year the Foundation contributed $26,000 for the establishment of an Opportunities Industrialization Center development facility in the Spring Garden Neighborhood.

Used House Rehabilitation Program. Kurt Solmssen is an executive in the company's International Division and is intensely interested in the Philadelphia community. He is a member of the City Planning Commission, and early last year Mayor James H. J. Tate asked the commission to tackle the problem of housing. At the meeting at which the problem was presented was a large wall map, marked to show the location of abandoned, dilapidated houses boarded up by the city. Solmssen noticed that many of the houses were in the Spring Garden area a few blocks from Smith Kline & French. He wondered whether the company might be able to do something about those properties.

Solmssen first talked to builders about the possibility of Smith Kline & French undertaking the fix-up by itself. The builders counseled against it as too risky.

Solmssen next considered whether the company might establish a revolving loan fund to be made available to builders at a preferential rate of interest. This, he thought, might launch a program of house rehabilitation in the Spring Garden area.

Consultations with the newly-organized, non-profit North City Corporation led to a meeting with The Philadelphia Housing Authority, a pioneer in the used house rehabilitation concept of public housing. Impressed with the proposal, the Housing Authority suggested the firm of Hertzfeld and Horowitz Associates as a logical developer. The firm had been in the used house program since its start. Hertzfeld and Horowitz was interested. The firm, however, did not need cash from the proposed loan fund in order to do the work. It was able to obtain the required capital from its bank. As an inducement for the developer to take on the Spring Garden program, Smith Kline & French agreed to pay about 40 percent of the interest cost on the loans, which would enable Hertzfeld and Horowitz to acquire the properties, remodel them and sell them to the Housing Authority.

The arrangement would apply on Hertzfeld and Horowitz's borrowing of up to $200,000 at any time, and the bank would bill Smith Kline & French directly for its share of the interest. It is expected that the maximum cost to Smith Kline & French will be between $10,000 and $20,000. SK&F also financed the employment of neighborhood men to serve as guards at construction sites to prevent vandalism and thievery. After the occupation of the first units, this proved to be no longer necessary.

Hertzfeld and Horowitz immediately began obtaining options and acquiring the first properties of the targeted 70.

Until now, the Philadelphia used house rehabilitation program has concentrated on single-family dwellings. The Spring Garden program marks a change. The houses are multi-family units and the developer had to prepare plans and estimates for Housing Authority approval with only experience in the single-family house program as a guide.

Each remodeled house has three apartments, one on the first floor and each of the other two occupying the second and third floors, one in the front and the other in the back of the house. The apartments, which have three bedrooms, are occupied by families eligible for public housing who have demonstrated responsibility. This is necessary because rehabilitated units are scattered and therefore less closely supervised than conventional public housing. Ultimately, the 70 properties will yield some 200 apartments.

The Housing Authority plans to try to locate in the remodeled houses people already in the Spring Garden area. Relocation problems will be minimized because the first units being remodeled all are vacant. St. Matthew's Lutheran Church in the neighborhood is assisting the authority in locating qualified tenants and in finding temporary housing during remodeling of occupied properties.

"Fallout" from the program already is evident. Seeing houses being fixed up instead of being torn down has inspired some residents of Mount Vernon Street to begin cleaning up. This is precisely what Smith Kline & French hopes to accomplish through the program, to stimulate the people of the area to improve conditions on their own. The company's belief is that there are enough solid citizens in the neighborhood to accomplish this. Also, the company had several telephone inquiries from owners of property in the neighborhood. They had given up hope of ever doing anything with the buildings because vandalism had taken such a toll. They, too, are watching the progress of the program.

In a recent speech, SK&F Executive Committee Chairman, F. Markoe Rivinus, introduced the concept of an "Urban Triad". Several pertinent paragraphs follow:

> "Our own work in the Spring Garden area suggests that there must be a blending of the resources, skills and experience of three elements in the community: government, business and the people themselves.
>
> "I would like to propose the concept of an Urban Triad, in which these three combine their talents to solve the problems of the urban ghetto.
>
> "Although I am not suggesting a specific form for this Triad, it seems clear that government will have to contribute most of the money, business the entrepreneurial leadership, and the people the grassroots enthusiasm—without which any neighborhood improvement effort is unlikely to flourish.
>
> "I mention government and money first, because the rehabilitation of a major part of our city will cost money—and only the government has the capacity to pay the bill. Along with money, we can certainly use the administrative skills of business. But money and administrative know-how are empty things unless used with heart and insight—for this, we need the involvement of those who know the needs of their communities at first hand.
>
> "Our cities are growing and will continue to grow. Urbanization is taking place with almost bewildering speed. Even as recently as a century ago, only 20 percent of Americans lived in cities. By the end of this century, government experts predict that four out of five Americans will live and work in a metropolitan area.
>
> "When we consider the complexities brought about by urbanization, we can hardly be blamed for looking back nostalgically to the simpler days of farm and small-town life. Instead of dreaming about our rural past, it's time to wake up and face our urban present and our increasingly urban future. If we plan intelligently, instead of following the haphazard growth patterns of the past, we can make our cities desirable places in which to live. The Model Cities Program offers us an incentive and a challenge. In meeting that challenge, all of us—clergy, educators, businessmen and community leaders—have a contribution to offer and a stake in the outcome. To paraphrase a well-known quotation: If we don't get the kind of city that we deserve, we will deserve the kind of city that we get."

SK&F's little war on neighborhood poverty resulted from a definition of priorities during four years of increasing community involvement. The company has involved itself directly in neighborhood affairs, has sustained its support of existing agencies, and has direct interest in four current projects. At this moment prospects are bright that industry and government can join hands successfully to try to find solutions to critical community problems. ☐

Mr. Haakenson is a member of the National Council of the National Society for the Study of Communication, Vice Chairman of the Business and Professional Speaking Interest Group of the Speech Association of America, and member of the Executive Committee of the Public Affairs Council of the Effective Citizens Organization. He received his B.A. from Augustana College and his M.A. and Ph.D. from the University of Iowa.

Experimental Tenement Rehabilitation

A LARGE PORTION of housing for low-income families in New York City is provided by the Old-Law Tenement Buildings. Records show that there are presently 43,000 Old-Law Tenements and 35,000 New Old-Law Tenements, housing approximately 1,000,000 families. Construction of these buildings was restricted in 1901 and 1927 when code changes provided for better facilities for light and ventilation.

Great similarities exist in the building configurations and structural design. Lot size and coverage restrictions resulted in a similar building configuration, 25 ft wide, 65 to 85 ft deep, and 5 to 6 stories high. The buildings, in general, conform to a dumbbell or T configuration with interior areaways providing light and air to interior rooms.

Structural Considerations

Structurally, the buildings consist of 12 to 16-in. unreinforced load bearing masonry walls supporting 3x10 joists spanning approximately 25 ft. Openings in exterior masonry walls are framed with brick arches. The walls are supported by continuous footings. Soil conditions vary in New York City from solid rock to loose fill placed over old marshes.

An industrialized solution for the rehabilitation of these structures must be developed if better housing is to keep pace with the rate of deterioration. This can be done by utilizing the latest construction technology in scheduling, materials handling, and the development of rehabilitation components which can be standardized for mass production. The uniform design of the tenement building lends itself readily to this type of development.

East 5th Street Rehabilitation Project

Three buildings were purchased by The Carolyndale Foundation, Inc., at 633, 635 and 637 East 5th Street, in New York City, to be used as a laboratory to develop a construction system which would reduce the time a tenant would have to be out of his apartment for rehabilitation to as short a time as 48 hours. This development was sponsored by a grant from the Low-Income Housing Demonstration Program, United States Department of Housing and Urban Development.

The design objectives of the program are:

1. *Restore health and safety.* Consideration was made for protection against fire and rats and roaches. Complete new electrical and plumbing systems were provided, as were refuse systems designed to improve waste removal.

2. *Increase livability.* Increased living space, better room layouts, and provisions for storage were provided.

3. *Minimize maintenance.* Consideration was made of the durability of materials which will minimize maintenance costs. Maintenance costs have a direct relation to the rents required to cover the total expenses.

Components were developed by test installation on the two vacant buildings, 635 and 637 East 5th Street. Installations were evaluated for installation time, cost, and compatibility with other materials. Floors, walls, windows, ceilings, utility service and demolition were analyzed for savings in cost and time.

Market availability was a consideration in selecting demonstration materials. The same materials were used for two buildings so the skills developed for one build-

RICHARD W. WICKERT, Conrad Engineers, New York, New York.

ing could be transferred to the other. Materials and techniques were selected for a trial demonstration on three typical floors of 637 East 5th Street.

Rehabilitation Techniques

Floors. 2 ft by 4 ft prefinished wood particle-board panels were used. The panels were face nailed directly into the existing flooring. This material had sufficient strength to span sharp irregularities and holes in the floor but no attempt was made to level the flooring. Several systems were developed which would level out major floor slopes; however, they were not utilized in this first demonstration because of the added complexity.

The 2 ft by 4 ft panel demonstrated the combination of a finish material and a subfloor into a single component. The material was easy to handle and could be installed rapidly. The finish and durability will be studied under actual usage.

Walls. Interior existing walls were resurfaced with vinyl covered gypsum wallboard attached to horizontal furring strips with adhesives and aluminum splines. The furring strips were nailed directly over existing plaster and were used to span over wall irregularities. Where interior partitions were required, the wallboard was attached to conventionally framed partitions. Several other wall surfacing techniques were developed which would eliminate the furring operation. These systems lacked the degree of prefinishing or fire resistiveness required in this particular system. Hallway walls were patched and refinished with an epoxy paint to provide a washable surface.

Windows. A prefinished window kit was developed which could easily and rapidly be installed in irregular openings. This kit consisted of a modified aluminum window and frame which could be installed over the existing wood window frames. The interior surround was manufactured of aluminum extrusions and vinyl covered particle-board. The surround was packaged in cartons and could simply be assembled with screws at he site. The surround incorporates the window trim mouldings and a panel above and below the window which eliminates tedious furring installation. The unit was designed to fit openings with varying sizes of plus or minus 1 inch and varying wall thicknesses of plus or minus 1 inch with no field fitting. Other units were developed of wood and steel which show great promise or further development.

Doors. Replacement of apartment entrance doors with rated fire-proof doors and frames was done using split frame and standard hollow metal doors. The plit frames are adjustable for varying wall thicknesses nd can be installed over existing wooden frames without decreasing the door size significantly. Interior doors re standard flush type doors installed in three-piece frames. Considerably more development work is warranted in this area to develop a prefinished, prehung nit with high durability.

Ceilings. A suspended ceiling system consisting of a standard grid system and prefinished gypsum board anels was used. The suspended ceilings provide a standard wall height on all floors in which standard closets and wall panels can be installed. They also provide a space between the ceiling and floor joist to run electrical wiring and ducts.

Other ceiling systems were analyzed for cost and availability. The fire resistive characteristics and code requirements for suspension systems restrict the use of many types of ceilings.

Service Cores. New plumbing, electrical systems, appliances and heating equipment were provided by the use of a preassembled service core. These units were fabricated into a structural unit which could be handled and supported independent of other structural devices. The units were installed through a shaft cut vertically through the building, and were stacked one on top of the other, plugging up the shaft. The core units support the cut floor beams, and the loads are carried by new foundations which were previously placed in the basements.

The particular units used for this demonstration were fabricated by the contractor using local trades and conventional materials which are generally accepted by the existing local building code. The standardization and the large numbers required for rehabilitation warrant further development of a mass-produced service core.

Demolition. The complete stripping of the interior of a typical tenement takes 3 to 6 weeks and results in approximately 28 40-yard trucks of debris. By utilizing portions of existing apartment layouts and selectively removing materials, the material removed was cut to about 8 40-yard truck loads. The use of a large capacity chute and planned stripping sequences resulted in a reduction of the demolition time to approximately 8 hours.

Rehabilitation Time and Results

Using these techniques and components, 637 East 5th Street was completely rehabilitated in 52 hours. Demolition was completed by the 9th hour, service cores were installed by the 18th hour and all utilities were functioning by the 33rd hour. This first dry run of the system served to point to new design details and revised techniques which will result in further time saving for the final 48 hour rehabilitation demonstration.

There have been many results of this experimental tenement rehabilitation project. It has been shown that standardized factory-produced components can be used to reduce the time and cost of rehabilitation substantially. The dramatization of a 48 hour schedule has stimulated both industry and the public to look for new answers to old problems. It was found that trade unions are not entirely blind to the need of innovation in construction, and that code acceptance of technological advancements is necessary to develop solutions to the great need for better housing. ☐

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Association Sponsorship of Housing Rehabilitation

THROUGH A JOINT COMMITTEE on Urban Rehabilitation Projects, the American Plywood Association, the National Forest Products Association and the Southern Pine Association are involved in a rehabilitation project in Cleveland. Together, they are helping a local nonprofit foundation turn two blocks in the heart of one of the worst slums in the country into a pleasant and attractive neighborhood.

The need for rehabilitation of dilapidated neighborhoods consisting of wood frame structures is at least as great as it is in the teeming tenement and apartment buildings of the ghettos of Harlem and Chicago. We decided to concentrate on this area, and to find a way to initiate a project of our own that would give us the information to produce the sales promotion elements needed to sell our products. This is how the project in Hough was born.

We are following a three-part concept of which the first element is a planning concept that will demonstrate how several or more blocks at one time can be re

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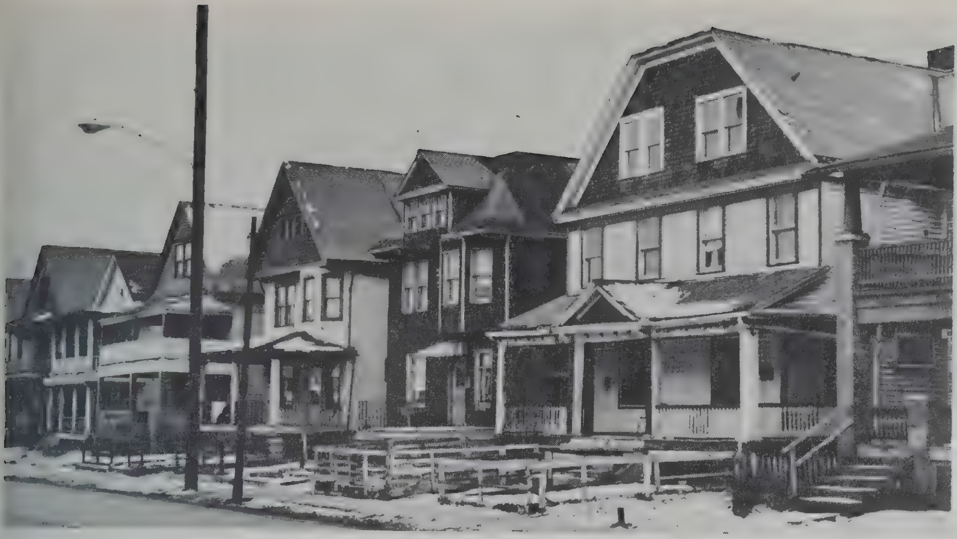


Figure 1. Typical wood frame dwellings in project show general nature of neighborhood in Hough District, Cleveland, Ohio.

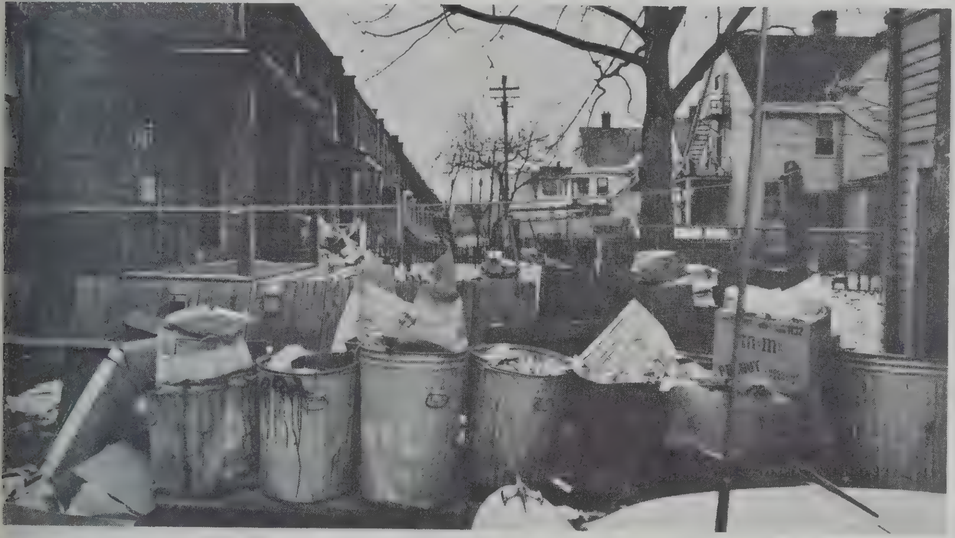


Figure 2. Cluttered condition of rear yards presents image of a seedy, neglected slum.

habilitated under a single comprehensive design program to create a new neighborhood instead of single unrelated elements.

The second element is a new team or joint venture approach to financing. Under this concept an industry sponsor contracts with a non-profit sponsor to provide the seed money for a substantial project. This seed money enables the non-profit sponsor to get the project under way with 100 percent financing under current FHA-insured mortgage rehabilitation programs. When the pay-outs begin, the non-profit sponsor returns the seed money to the industry sponsor who is then free to move into another project.

Finally, we will demonstrate the most effective and economical ways wood can be used in rehabilitation and we will provide the research and testing required to prove our new ideas in application methods.

Hough Participants

American Plywood Association is a trade association representing producers of about 85 percent of the softwood plywood manufactured in the United States. Members subscribe to a comprehensive quality inspection and testing program, research on basic properties and new applications, and promotion.

National Forest Products Association is a federation of wood products associations headquartered in Washington, D. C. Its primary functions are government liaison, public relations, resource relations, and coordination of programs necessary to a healthy growing industry.

Southern Pine Association represents producers of softwood lumber, primarily southern pine, in twelve southern states from Texas to Virginia, and from Oklahoma to the Gulf. Headquarters are in New Orleans, Louisiana.

HOPE is a non-profit organization created two years ago in Cleveland for the purpose of providing improved housing conditions for the people of the Hough area of Cleveland. It is also concerned with the human aspects of rehabilitation and has a Human Renewal Committee, with provisions for the planning and supervision of programs which serve tenants and other residents' needs in the areas of homemaking, money management and child care. HOPE's first project, the 21-unit Belvidere Apartments, has just been completed. As a non-profit sponsor of the project in which the associations are engaged, HOPE will eventually hold title to the rehabilitated property and will be responsible for long-term management.

Hough Physical Status

Hough is a seedy, neglected slum halfway between the city's downtown shopping and business core, and a growing dynamic cultural center. Neighborhood scenes are shown in Figures 1 and 2.

Until the beginning of the 1950's, Hough was a community of white residents in the middle-income bracket. It was a pleasant community, located only ten minutes by automobile from downtown Cleveland. Thousands of present-day Clevelanders, including some of the city's most successful and affluent citizens, were born and raised in Hough. In the decade beginning with 1950, Hough underwent a dramatic population turnover. More and more Negroes moved in and the whites moved out. Today, Hough is a Negro community.

Many of the whites who left are still renting their former homes to Negroes, but as absentee landlords. Maintenance and upkeep of the homes have been ignored. Scores of homes have been simply abandoned. In many cases, these homes have been vandalized, almost to the point of total destruction.

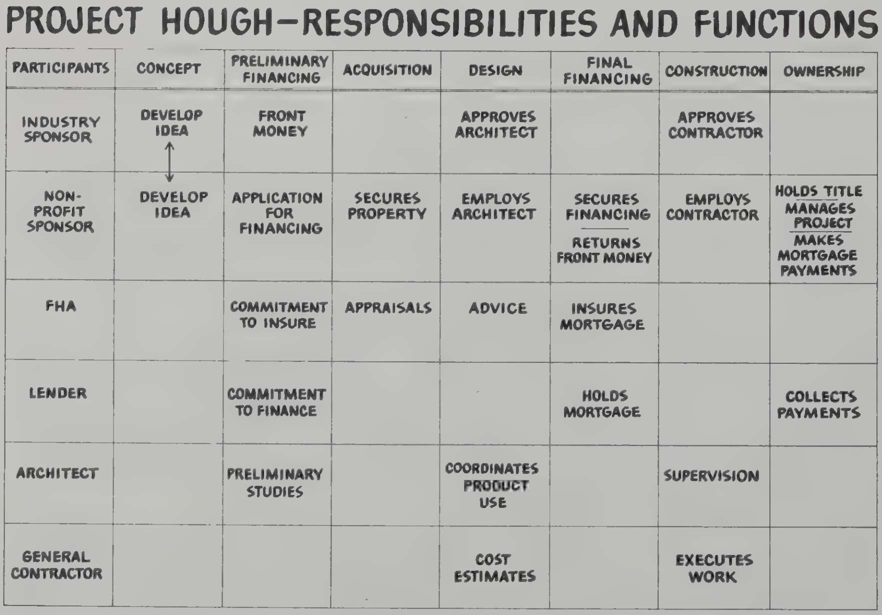
The area selected for the project covers two city blocks and includes 54 separate buildings, not counting the two buildings which comprise the Belvidere Apartment project. Ten of the buildings are row and terrace-type multi-family buildings, having a total of 77 dwelling units. The remaining 44 buildings are detached wood frame, having 63 units, for a total of 140 units in the project.

The row and terrace-type structures have brick bearing walls and wood joists. They are two and three-story structures with basements. The brick exterior walls appear to be in fairly good condition, at least there are no obvious signs of foundation settlement in spite of their 60 to 70-year age. The interiors of the buildings are in fair to very poor condition, often with sagging wood floors, damage to interior and exterior wall surfaces, and worn-out plumbing, wiring and heating systems. The wood frame buildings have adequate structural frames, in need of refurbished skins, and the same interior deterioration as in the other buildings. Side and backyards, in some cases, are cluttered with trash, deteriorating outbuildings and abandoned automobiles.

Hough Project Organization

Figure 3 is an over-simplified organization chart of the various relationships involved.

The industry sponsor on the chart in this case is represented by the three associations; the non-profit sponsor by HOPE, Inc. The lender will be the Women's Federal Savings & Loan Association in Cleveland. The architect is A. Quincy Jones of the well-known firm of Jones and Emmons, Los Angeles. The general contractor is yet to be determined although we have been working closely in the initial phases with Cleveland Land Associates,



PROJECT HOUGH—RESPONSIBILITIES AND FUNCTIONS

PARTICIPANTS	CONCEPT	PRELIMINARY FINANCING	ACQUISITION	DESIGN	FINAL FINANCING	CONSTRUCTION	OWNERSHIP
INDUSTRY SPONSOR	DEVELOP IDEA	FRONT MONEY		APPROVES ARCHITECT		APPROVES CONTRACTOR	
NON-PROFIT SPONSOR	DEVELOP IDEA	APPLICATION FOR FINANCING	SECURES PROPERTY	EMPLOYS ARCHITECT	SECURES FINANCING RETURNS FRONT MONEY	EMPLOYS CONTRACTOR	HOLDS TITLE MANAGES PROJECT MAKES MORTGAGE PAYMENTS
FHA		COMMITMENT TO INSURE	APPRAISALS	ADVICE	INSURES MORTGAGE		
LENDER		COMMITMENT TO FINANCE			HOLDS MORTGAGE		COLLECTS PAYMENTS
ARCHITECT		PRELIMINARY STUDIES		COORDINATES PRODUCT USE		SUPERVISION	
GENERAL CONTRACTOR				COST ESTIMATES		EXECUTES WORK	

Figure 3. Responsibilities and functions of organizations involved are shown.

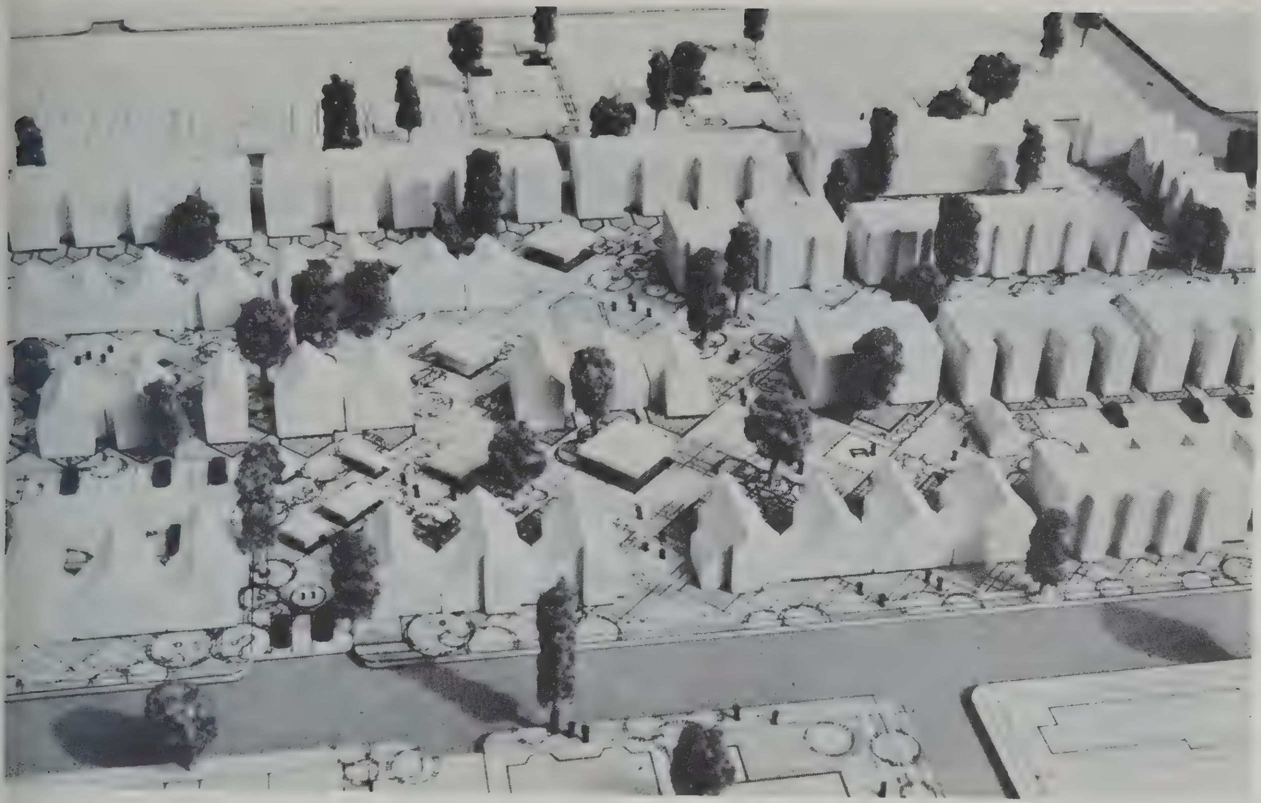


Figure 4. Model of proposed plan illustrates general concept of rehabilitated neighborhood.

Inc. which specializes in all phases of real estate, including design and construction. They served as consultants to HOPE, Inc. on the Belvidere Apartment project.

Hough Project Operation

A project like this gets under way with the development of the basic idea or concept. In this case, the concept was ours and was worked out in cooperation with HOPE.

The industry sponsors are responsible for providing seed money as needed. In our case, we are estimating this will run anywhere from $100,000 to $150,000. We expect to get a substantial portion of that back, although realistically, since this is a prototype operation, we expect to leave a portion of that sum in the project.

HOPE, Inc. makes the actual application for financing and it is at this point that FHA enters the picture with at least a preliminary commitment to insure. At this stage in the development of the project, we anticipate the use of 221(d)(3) Rent Supplement financing. HOPE, Inc. has also lined up the lender who has provided a commitment to finance.

It is HOPE's responsibility to secure options on the property involved, or to make outright purchases. The seed money is intended to cover this aspect as well as the preparation of the detailed application for financing. FHA is of help at this stage with preliminary property appraisal so that the economics of the project do not get out of line.

Under our contract with the non-profit sponsor, we have retained the right to approve the selection of the architect. Our objective here is to secure a high standard of excellence in the architectural design since this is a demonstration project. The three associations have retained the architect for preliminary design studies, most of which will be compensated for by the mortgage. FHA provides advice as needed.

In our case, the architect will also serve a very important function in coordinating the requests for product demonstrations in the project.

The non-profit sponsor actually secures the formal financing for the project, prepares and submits the application. When the mortgage money becomes available and payoffs begin, HOPE, Inc. will return the seed money to the three associations. The FHA insures the mortgage, the lender holds the mortgage.

Again under our contract with the non-profit sponsor, we retain the right to approve the selection of the general contractor. We asked for this right to assure ourselves that there would be a competent contractor on the job, sympathetic with the aims of the project insofar as they relate to demonstration and promotion. The non-profit sponsor actually employs or contracts with the builder and finally the contractor executes the work.

Finally, as the project is completed, the non-profit sponsor emerges as the owner of the property. HOPE, Inc. holds title, manages the project, rents the property, collects rent from the living units and makes the mortgage payment. The lender collects the mortgage payments until the debt is retired.

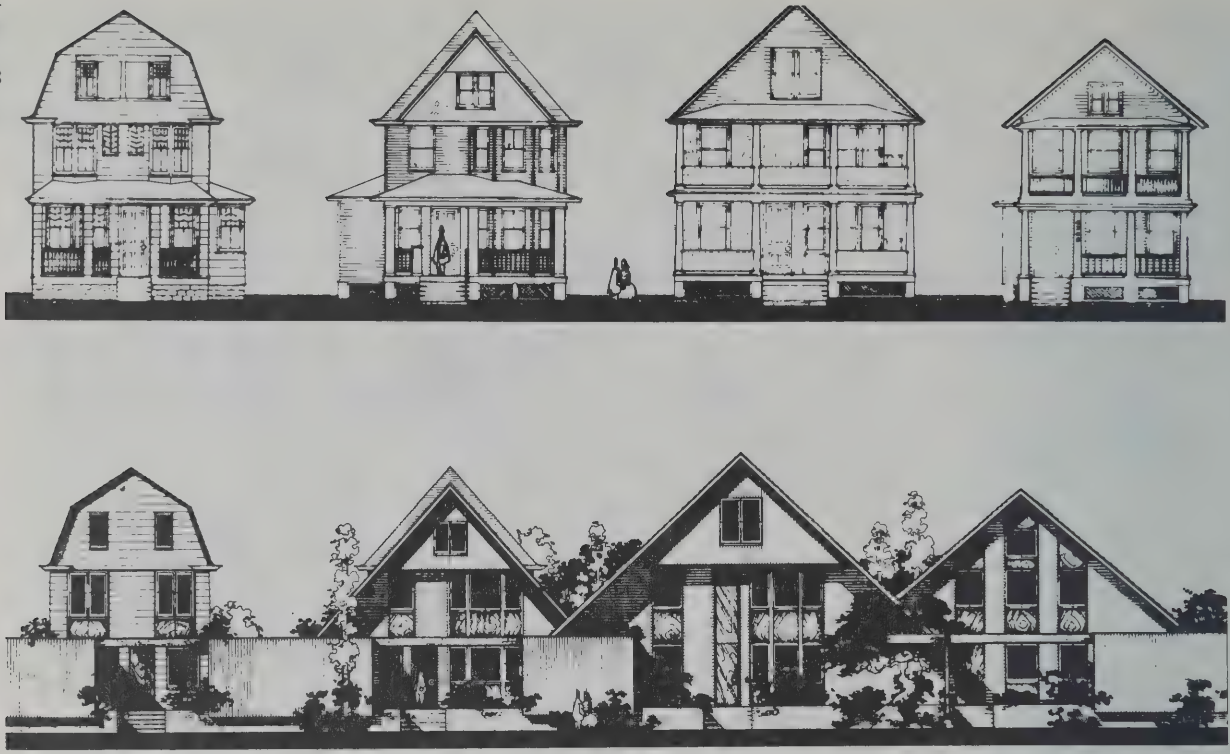


Figure 5. Illustration of concept to gain additional living space at low cost by joining units together.

Preliminary Design Studies

Two alternative land-use schemes have been prepared. Both of them involve the closing of a narrow, one-way, east-west street that separates one block from the other. The space thus created is used for open play space and other community activities. Provisions have been made for off-street parking for at least one vehicle per dwelling unit. Both plans also provide for small stores, some neighborhood industry, and educational and recreation facilities. A plan and model of one proposal is illustrated in Figure 4.

Early in the development of these plans it was discovered that the economic feasibility of the project was questionable if only the existing units were rehabilitated and available for the production of income. Mr. Jones then set about seeking ways to increase the number of units to improve the feasibility. It was found that certain of the larger row houses could be subdivided to produce units with fewer bedrooms. Of course, it is not practical to so divide all row houses because there is a need for some units having five bedrooms.

A scheme was also developed for converting some of the single family frame dwellings into two-family structures by extending rooflines to their intersection over sideyards, constructing end-walls, and adding floors. This would allow one unit on the ground floor, another unit on the second floor. This is illustrated in Figure 5. By these and other methods, the number of units can be increased from 140 to as many as 180. In so doing, the project at this stage appears feasible.

One of the interesting aspects of the project is that of the 140 living units, 15 are owned by residents who wish to remain in the project. Their cooperation will involve concessions on their part to allow HOPE, Inc., freedom to use spaces surrounding their buildings to provide continuity of design, maintenance and, of course, provisions for services.

Hough Project Results

Although the three participating associations have been involved in the project for only a short time, several observations can be made which will be of assistance to other organizations interested in the same type of activity. It is important to recognize that local, non-profit sponsors with whom the industry or civic group will cooperate may need administrative assistance. These groups will be largely volunteer organizations and, as such, will require money to employ a staff or consultants or a contribution of manpower from the cooperating industry group to assist them in taking the initial steps. This will help save valuable time after the industry group has committed itself to the project.

The Federal Housing Administration, beginning with the district office, and including the Rehabilitation specialists in Washington, D. C., should be consulted at the outset. Their helpful assistance actually makes possible such projects as this. ☐

Mr. Brown is a member of the American Society of Civil Engineers and the Structural Engineers Association of Washington. He has been Manager of the Applied Research Department of the American Plywood Association. He holds a B.S. in Civil Engineering from the University of Washington and an M.S. in Civil Engineering from Lehigh University.

RELATED TECHNICAL PAPER

The Building Research Institute welcomes technical papers, not presented as a part of BRI Conferences programming, to be considered for publication in the Journal. The paper which follows was submitted in response to this policy. Readers are reminded that technical material may be submitted at any time. It will be reviewed and, if accepted, will be published in Building Research at such time as pages for the purpose become available.

The Cost of Rehabilitation

MOBILIZATION FOR YOUTH recently undertook a development program on New York's Lower East Side. As a part of that program the Housing Department evaluated a variety of building alternatives. The material set forth in this article was a result of this research effort in the field of housing. Much of the data are, therefore, relative to the type of development and conditions found in an area like New York's Lower East Side. This report, and the entire effort in housing by Mobilization for Youth, was supported by a grant from the Ford Foundation.

This study is intended to serve in the development of a comprehensive reconstruction program for a part of the Lower East Side. To the degree that rehabilitation is an appropriate method, this report will be used in estimating the economic requirements for such a program.

The following cost analysis and estimate are based on current methods of rehabilitation. These generally involve the use of traditional building trade skills and materials to rebuild an existing structure. There is little difference in rehabilitation costs, no matter what conventional rehabilitation methods are used. Essential cost savings would result only as a consequence of a change in the rehabilitation process from a handicraft to a manufacturing process.

Methodology Used in Determining Costs

No up-to-date published material describes the cost of rehabilitation for tenement buildings in the City of New York. In developing the material for this report, the Housing Department has relied on conversations with housing experts and builders who have executed rehabilitation projects. Cost estimates for the various aspects of rehabilitation were obtained in these discussions.

Variables Affecting Costs

One significant variable affecting rehabilitation costs is the scope of the work. The scope is defined, on the one hand, by the extent of work undertaken, and on the other, by the quality of workmanship specified for the project.

The extent of rehabilitation can vary widely. At one extreme is the job in which the non-bearing exterior walls are demolished and all of the interior partitions and mechanical system are removed. At the other extreme is the job in which the only structural removals are of minor room-dividers within pre-existing apartments. The typical tenement house rehabilitation usually extends far beyond the lesser limit, but does not reach the demolition of exterior non-bearing walls.

Quality variations are related principally to the selection of major fixtures, appliances, and mechanical equipment, or to the level of workmanship sought in the rehabilitation. However, as the cost of these products is a

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mall part of that of the total project, the quality of re-abilitation is a relatively minor cost variable.

A second major variable affecting the cost of re-abilitation is the price of labor. The labor cost in ehabilitation generally varies from 60 to 70 percent f the total cost of material and labor. The relationship etween the cost of labor and the cost of materials varies vith the trade being considered. For example, in nasonry work the typical relationship is 70 percent of osts for labor and 30 percent for materials. In the ase of painting, the ratio may be as high as 75 percent or labor to 25 percent for materials. In carpentry work nvolving flooring and sheet rock, in which the materials re expensive but quickly applied, the cost ratio is ivided evenly between labor and materials. Only in ituations in which the materials are costly but quickly nstalled will material expenses exceed the cost of labor.

Most current rehabilitation in New York City is arried out by small construction firms. In such opera-ons, only the lead workers in a labor crew receive the revailing union-scale rates and fringe benefits.

In the final analysis, the difference in cost between fully or partly-unionized labor crew is not excessive. or example, the cost of plumbing and electrical work basically the same whether or not the workers are nion members. It is in the carpentry, masonry, and rick laying trades, among others, that the cost of non-nion labor is significantly less. Even this statement ust be qualified, however, because union labor in these ades is more highly skilled, and if labor costs are igher, production time is less. Second, labor cost repre-ent only a small part of the total rehabilitation cost ructure. Therefore, a saving on labor costs will tend be offset by other project cost variables.

An additional factor affecting labor costs is whether e rehabilitation is carried out under programs of the ederal Housing Administration. The most significant st difference is between a complete union, FHA re-abilitation project, and a non-union project exempt om FHA standards. It is estimated that the savings e approximately 20 to 35 percent of the total project sts. Not only are labor costs lower, but fees are also ss. Moreover, the non-FHA project may use less ex-nsive materials and similar cost-saving devices.

The third major variable affecting the cost of re-bilitation is the cost of financing—both temporary d permanent. Project costs are increased when re-bilitation is financed with private money at existing arket interest rates. This is especially true for periods ch as the present when the cost of money is high. wer rehabilitation costs can be achieved when financ-g is obtained under federal insurance programs for n-profit corporations. However, the cost difference tween these alternatives is not as great as may be sumed. First, the administrative expense involved in taining an FHA-insured mortgage adds significantly total project costs. Second, the non-profit operation, ile not necessarily less efficient than the private-profit operation, does entail additional expenses, such as those of community organization, which may tend to offset financing costs.

The fourth major variable affecting rehabilitation costs is the entrepreneurial motive. A rehabilitator may be a builder-contractor who undertakes a project which he will retain for his own use as a short or long-term real estate investment. Obviously, such an entrepreneur can minimize the profit on the construction itself. Differently motivated, however, is the contractor who executes a rehabilitation project for either a profit or a non-profit sponsor. In the former situation, no standard builder's profit is added to the total project cost. In the latter situation, however, the contractor must make all of his profit from the construction itself. Ten percent of the material and labor costs, more or less, is added to project costs for the builder's profit in the latter case. The actual amount of builder's profit may vary considerably from this figure in relation to the current demand for the services of small-scale construction firms. If, however, a specialized contracting firm is more efficient than a builder-contractor, the profit may not be reflected as a final savings.

A fifth major rehabilitation variable, the "intensity" of the operations, affects the time in which a project can be completed more than it affects project costs. The factors involved in the intensity of operations include the size of the building company and the number of buildings to be rehabilitated, either at one time or in one location. The single building project is usually the province of the small contractor. Large-scale projects involving the rehabilitation of a large number of buildings at one time, or a number of buildings in the same area over an extended period of time, are usually carried out by larger companies. The speed and efficiency of the larger contractor are reflected in savings in taxes during construction, interest, and insurance costs which are directly related to the duration of the project. Additional savings may reflect decreased costs of transporting equipment from one building to the next, and growing familiarity with building type, site and local conditions. Greater specialization and better equipment may also produce savings.

Balancing the advantages of the larger construction firm, the small-scale contractor can be more selective in purchasing supplies and providing on-site supervision.

The Typical Rehabilitation Project

The type of building selected as the principal candidate for a rehabilitation project is the old law tenement. This is a masonry building five or six stories high with an average exterior width of 25 ft and a depth of approximately 80 ft. The typical "double-decker" old law tenement contains 24 dwelling units, or 22 dwelling units and two small stores. These dwelling units are of limited value for large families. There are only four rooms in the largest such unit, and the individual rooms are small and substandard in terms of space.

For the purpose of developing realistic and useful estimates, it is assumed that two dwelling unit lines (12 out of the 24 units in the typical double-decker) will be combined into six larger units. Upon completion, the total number of units in the building will have been reduced to 18, a loss of 25 percent or more, depending on the number of original units.

Other building types in the area include the new law tenements and the three-story masonry walk-ups. The new law tenement typically contains 24 units. Rehabilitation costs for a new law tenement on a unit-by-unit basis are believed to be similar to those for old law tenements, although they may be slightly less because the units are generally in better condition than their old law counterparts. Conversely, the rehabilitation of smaller buildings, such as the three-story masonry structure, will cost more per unit because there are fewer dwelling units to carry costly standard rehabilitation expenses, such as those of the mechanical system and the higher proportion of common-area work per total number of dwelling units.

Component Costs of Pilot Area Rehabilitation Project

In developing a projected cost estimate for rehabilitation on the Lower East Side, we have chosen from among the variables indentified above.

The first variable is the scope of rehabilitation which may be divided, as noted, into the extent and the quality. We will comment only on those questions of extent which affect major cost differences. These questions include alternative arrangements of space layout, new front walls, public elevators, and garbage chutes.

It is assumed that rehabilitation within the area of the Lower East Side will include the complete gutting of all interior partitions and of all the sub-standard sections of the building's mechanical system, but exclude any major change to floors or exterior walls.

An elevator's effect on the cost of rehabilitation per unit is inversely proportional to the number of units which it serves. If the rehabilitation of a building results in fewer units, then the cost of an elevator installation increases drastically per remaining unit. If, on the contrary, rehabilitation results in a greater number of smaller units, the cost of the installation on a unit basis will decrease. Since, on the Lower East Side, the primary housing need is for larger apartments, most rehabilitation will involve a decrease in the number of units per building.

Elevator installation for a six-story building is presently quoted at a price of $18,000 to $20,000, or approximately $1,000 per unit. If, as is technically possible, an elevator is installed to serve two adjacent buildings, the per unit cost would be reduced to approximately $500.

Due to legal restrictions, incinerators will be less common in rehabilitation projects as time goes on. However, garbage disposal remains a major problem facing the future tenant. The garbage chute, as installed in the 114th Street Project and in Mobilization For Youth's Fourth Street Project, currently appears to be the most practical solution to the problem. The cost of this installation is approximately $3,000 per typical old law tenement, or about $190 per unit.

In describing the quality of rehabilitation specified for our area projects, it is assumed that the materials used will satisfy the owner and the occupant as manager and consumer respectively. For example, it is assumed that brass plumbing will be used, bathrooms will be tiled to a 4 ft 6 in. height, and finished marble treads or treads of equivalent quality will be used in all public areas. Equipment such as refrigerators, stoves, and cabinets will be brand name and of a size sufficient to meet the needs of the family expected to use the apartment. They will not be from the bottom of the quality line.

Standard Costs and Fees

The expense of all material and labor needed to complete a rehabilitation project is commonly termed the "brick and mortar" costs. These costs include all labor, lumber, electrical wiring, plumbing and heating equipment, glass, waterproofing, sinks, stoves, cabinets, and other materials that go into the reconstruction of a building. For a two-bedroom apartment, the lowest estimate of brick and mortar costs is $7,000 and the highest is $10,000 per unit. Most estimates range from $7,500 to $9,000 per unit. These figures assume current prices for material and labor. If, during rehabilitation, the number of existing dwelling units is reduced in order to increase the average number of rooms per apartment, the total brick and mortar costs for the entire project are only slightly reduced. Although any significant increase in the size of dwelling units will reduce the expense of a building's mechanical system, this saving is generally absorbed in the cost of remodelling smaller apartments into larger ones.

FHA Allowances and Fees

Architectural costs differ depending on whether a project is to be insured under a Federal Housing Administration program. The standard FHA allowance for architectural design fees is approximately 5 percent of the brick and mortar cost. For the moment, if it is assumed that brick and mortar costs are $10,000 per dwelling unit, using the standard 18-unit building, the architect's fee under FHA would be $9,000 for the total project. Services included under the FHA architect's fee are the preparation of approved plans and the development of full specifications to FHA standards.

Private developers report paying far less than 5 percent for architectural services. For a standard rehabilitation project, the private developer's price for non-FHA architectural services is approximately $1,200 to $1,500; the private developer's price for FHA-approved plans and specifications is approximately $3,000. However the private developer who undertakes an FHA project assumes far greater responsibility for on-the-job supervision than does the non-profit sponsor who relies on the architect for these services.

Depending on whether a project is FHA insured, here are FHA fees and other standard fees which con- ribute significantly to the cost of rehabilitation projects. The FHA fees are principally charges for the administra- ive costs it incurs while processing the project. The najor exception is the interest rate for financing the ermanent mortgage which is approximately 3 percent nder the FHA 221 (d)(3) BMIR program and ap- roximately 6 percent of the mortgage on the private narket. Fees which are standard whether or not the ehabilitation is an FHA project are the costs for fire nd liability insurance, title and recording fees, and egal and organizational expenses, as well as the neces- ity of providing a special fund for early operating xpenses.

The final costs to be considered are the acquisition ost of the land and building, the family relocation ost, and the cost of the construction loan necessary or financing the actual rehabilitation. The acquisition ost estimate in low income areas ranges from $500 to 2,000 per dwelling unit. This estimate is based on ctual per-unit prices for rehabilitation projects now in xecution. The lower end of the scale reflects the cost f buildings which are in poor structural condition and o longer profitable business investments. The high nd of the scale reflects the cost of buildings which are essentially sound condition and going operations at e time of acquisition.

The estimate of relocation costs is $1,000 per family. Thile this estimate is high, it is based upon the as- mption that relocation must be handled on the basis individual family needs so that costs are higher than e price of the physical move alone. On the Lower ast Side, where there is only a small percentage of cant buildings suitable for rehabilitation, any sizable using program would require substantial relocation.

At present, the charges for construction loans on the ivate market are 6 percent of total project costs, acement fee, 0.5 percent service fee, and 6 percent terest. Normally, with conventional financing, it is t possible to obtain 100 percent of total project costs. ly with the use of Federal programs such as 221 (d)) or New York State's programs such as the Travia t, can 100 percent financing be obtained. Therefore, e cost of conventional rehabilitation is equal to the ney which must be invested by the builder or de- loper in the project.

It is difficult to predict the trend of the money market er the next 10 or 20 years, but these interest rates for nstruction loans have been projected as a working pothesis for the next four years.

nal Cost Estimate Calculation

An additional calculation has been made upon which rehabilitation cost estimate is not strictly contingent. is calculation accounts for the inflationary trends in economy. This calculation projects an inflationary tor of 4 percent per year over an average of the next r years. Although the 4 percent is considerably more than the standard inflationary factor for new construction, rehabilitation projects tend to be small and of greater financial risk.

Table 1

ESTIMATED REHABILITATION COSTS

Rehabilitation Costs	FHA Insured		Non-FHA	
	With Elevator	Without Elevator	With Elevator	Without Elevator
Material	$ 2,900	$ 2,900	$ 2,900	$ 2,900
Labor	5,400	5,500	5,400	5,400
Subtotal	8,300	8,300	8,300	8,300
Elevator	500	—	500	—
Subtotal	8,800	8,300	8,800	8,300
Builder's Overhead and Profit	900	800	900	800
Subtotal	9,700	9,100	9,700	9,100
Architect's Fee	500	500	100	100
Rehabilitation Fees	900	900	1,100	1,000
Subtotal	11,100	10,500	10,900	10,200
Acquisition Cost	2,000	2,000	2,000	2,000
Subtotal	13,100	12,500	12,900	12,200
Construction Loan Financing	900	800	900	800
Subtotal	14,000	13,300	13,800	13,000
Contingency	1,400	1,300	1,400	1,300
Subtotal	15,400	14,600	15,200	14,300
Inflationary Factor	2,600	2,400	2,600	2,400
Total	$18,000	$17,100	$17,800	$16,700

Total Development Cost Estimate

The estimated cost of rehabilitation has been developed from its eight principal components. These are the brick and mortar costs, including material and labor costs; the builder's overhead and profit; architectural fees; rehabilitation fees, whether private market or FHA; acquisition (including relocation); construction loan financing; the contingency factor; and the inflationary factor.

The estimate is based upon a constant cost of materials for a two-bedroom unit. Since some of the costs, such as builder's profit or architectural fees, are based on the project cost, the estimate was calculated on a cumulative basis.

It is estimated that the rehabilitation of a two-bedroom old law apartment will cost between $14,000 and $15,000 at present cost levels. If present prices for money, materials, and labor continue to increase, it is estimated that by 1971 it will cost between $17,000 and 18,000 to rehabilitate the same apartment. These costs are broken down in Table 1. ☐

Mr. Abeles is a member of the American Society of Planning Officials. He was formerly Director, Housing Department, Mobilization for Youth, Inc., New York, New York and was a consultant to the Ministry of Housing of the Government of Israel from 1959-1962. He received his B.S. from Cornell University and his M.C.P. from the Massachusetts Institute of Technology.

Selected publications of current interest to the building scientist are reviewed. Please order direct from publisher. Do not order from BRI.

Suggested Reading

BOOKS

Legal Pitfalls in Architecture, Engineering, and Building Construction. *Nathan Walker and Theodor K. Rohdenburg; McGraw-Hill Book Company, 330 West 42nd Street, New York, New York 10036; 1968, 260 p. plus index, $11.95.*

This book is designed to make the practicing architect, engineer, or building contractor aware of the common legal pitfalls that have trapped others in these professions. Legal principles are explained in nonlegal terms through the use of many examples and cases. Special forms are included to enable the reader to have a better understanding of the legal problems being considered, and additional forms are included at the back of the book.

The volume, coauthored by a lawyer and an architect, reflects the knowledge and experience associated with each of these fields. It stresses the importance of written agreements stipulating all contingencies, with reference to compensation, cost limitations, and professional duties; discusses the responsibility of the architect to the public; and supplies information on license requirements.

After detailing the legal pitfalls occurring in the owner-architect relationship, the book considers legal pitfalls in the owner-contractor relationship, with particular attention to contracts, standards of performance, and liability. The contractor's liability to the public is also discussed. Other topics covered are legal pitfalls arising out of the relationships of several contractors, arbitration, liens and bonds, special contract provisions, partnerships and consultant situations.

Legal citations are not included in the text, but they do appear in an appendix of case references. The authors do not attempt to present every legal facet of architecture, engineering, and building construction, although they have selected those legal problems which most frequently arise in the day to day activities of the architect, engineer, and contractor. Legal principles are not explained by a profusion of cases, but by one or two simple, interesting, and practical illustrations.

Thermal Performance of Buildings. *J. F. Van Straaten; American Elsevier Publishing Company, Inc., 52 Vanderbilt Avenue, New York, N. Y. 10017; 1967, 311 p., $13.00.*

Part of American Elsevier's Architectural Science Series, this book outlines design principles with respect to thermal and ventilation conditions of buildings. It is designed to be used by architects, engineers, building inspectors and building scientists.

The author is on the staff of the National Building Research Institute of the South African Council for Scientific and Industrial Research and in consequence most of the work upon which the book is based has been done under warm weather conditions.

Trial and error methods of solving problems were formerly used in designing commercial, industrial, and public buildings, but these were usually costly and rarely successful, and they did not lead to a true understanding of the factors or principles involved. Apart from this, architects and engineers have not always made use of the body of knowledge that does exist, and many of the unsatisfactory thermal and ventilation conditions found in buildings could have been avoided if the designers had applied the approved principles of functional planning and design described in this volume.

Science, Engineering, and the City. *(A report of a Symposium sponsored jointly by the National Academy of Engineering and the National Academy of Sciences, April 26-27, 1967). NAS-NAE-NRC Publication 1498, Printing and Publishing Office, 2101 Constitution Ave., N.W., Washington, D. C. 20418; 1967, 152 p., $4.50 (paper).*

This new publication assesses the current interaction of technology with urban problems and outlines a set of tactics to guide planning and design.

By 2000 the population of the United States will be 312 million, 17 million of whom will be clustered in 14 major urban regions. This explosive growth is only one of many factors complicating the task of those engaged in urban planning and design. Sound devel
ment of urban areas depends not o
on the use of sophisticated mat
matical models and other new techni
tools, but upon the acceptance of
inescapable importance of sociologi
economic, and political consideratio

In recognition of the existence of t
dynamic interaction of social and te
nological forces, the NAE and the N
have issued this book presenting pap
by noted authorities in the field of ur
development. The papers, which
phasize the immediacy and importa
of urban problems, provide valua
information and ideas for solving th
problems. The book is divided i
four major areas, including social
quirements for urban design, ur
transportation problems, urban c
struction, and urban experimenta
program.

Air Conditioning Engineering. *W. P. Jo
St. Martin's Press, Inc., 175 Park
enue, New York, New York 100
1967, 494 p., $18.00.*

This book contains a thorough prese
tion of the theory and practice of m
ern air conditioning systems and eq
ment, intended for those intereste
the design and efficient operation o
dividual units as well as central syste

Much of the material included in
volume is based on data relating
North American air conditioning p
tice as summarized by ASHRAE,
though the book makes considera
reference to the British data of the
stitution of Heating and Ventila
engineers. Many of the illustra
problems are worked out for student
detail and are adaptable to Un
States conditions. The basic theor
the same on either side of the Atla

Chapters include the need for
conditioning, fundamental propertie
air and water vapor mixtures,
psychrometry of air conditioning p
esses, comfort and inside design co
tions, comfort and outside design
ditions, the choice of supply de
conditions, and heat gains from s
and other sources.

Also they include, cooling load,
fundamentals of vapor compression
frigeration, cooler coils and air wash
the rejection of heat from conden
and cooling towers, refrigeration pl
automatic controls, vapor absorp
refrigeration, the fundamentals of
flow in ducts, high velocity syste
ventilation and a decay equation,
filtration index. ☐

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Building Research

THE JOURNAL OF THE BUILDING RESEARCH INSTITUTE | APRIL-JUNE 1968

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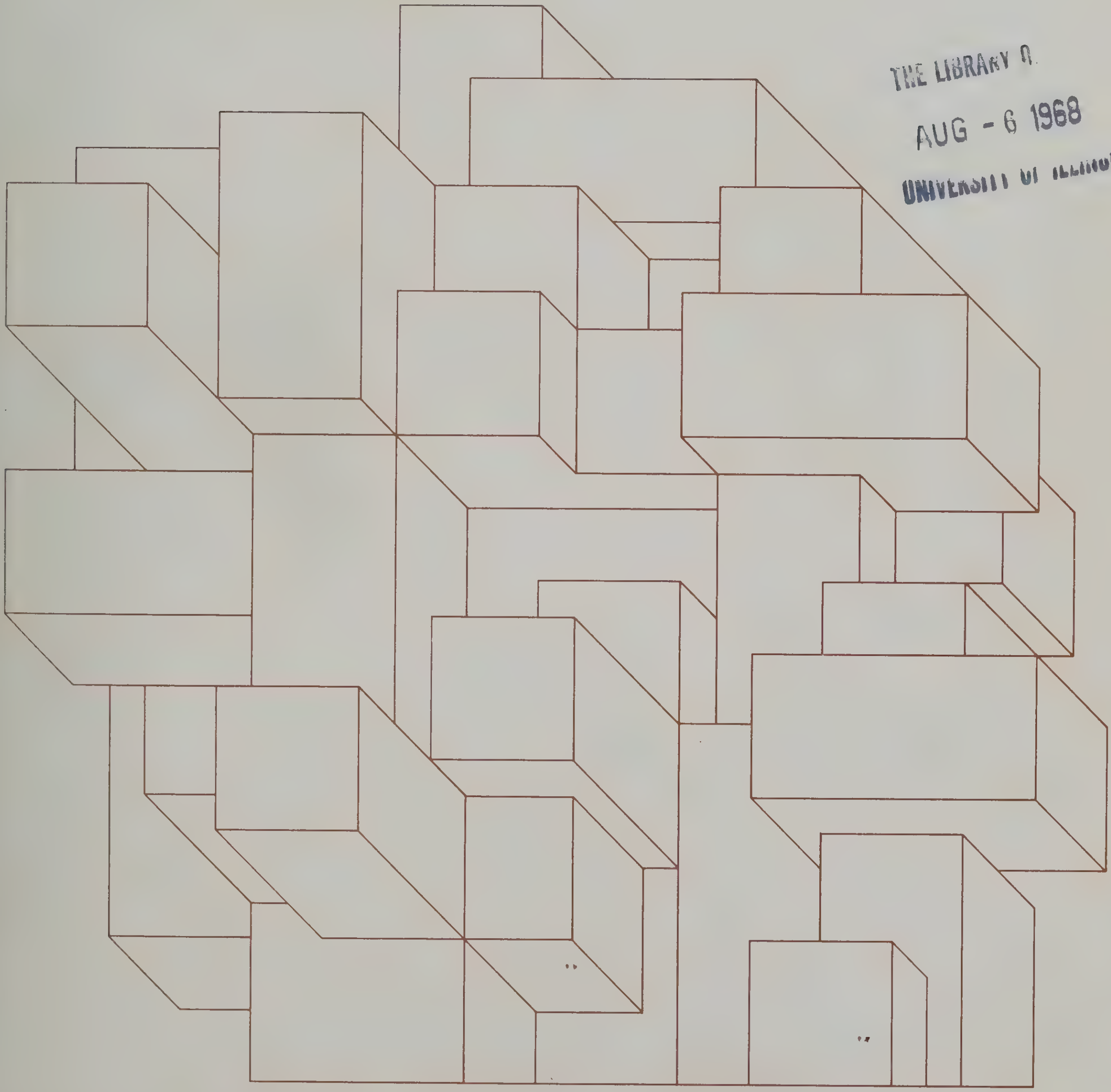

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BUILDING RESEARCH INSTITUTE ANAHEIM SEMINARS

September 17-18-19, 1968
Anaheim Convention Center, Anaheim, California

TENTATIVE SEMINAR SCHEDULE: (Each seminar is repeated once.)

A. JOINT SEALANTS—EXPERIENCE AND NEW TECHNOLOGY
September 17, 3:00-5:30 p.m. and September 18, 9:00-12:00 a.m.

B. ROOF BONDS
September 17, 3:00-5:30 p.m. and September 18, 9:00-12:00 a.m.

C. GLASS IN BUILDING DESIGN AND CONSTRUCTION
September 17, 3:00-5:30 p.m. and September 18, 9:00-12:00 a.m.

D. ENERGY AND LIGHTING AS RELATED TO BUILDING DESIGN
September 18, 2:00-5:00 p.m. and September 19, 9:00-12:00 a.m.

E. PRECAST AND PREASSEMBLED CONCRETE SYSTEMS AND COMPONENTS
September 18, 2:00-5:00 p.m. and September 19, 9:00-12:00 a.m.

F. BUILDING DESIGN PROGRAMMING
September 18, 2:00-5:00 p.m. and September 19, 9:00-12:00 a.m.

LOCATION—The Anaheim Convention Center is approximately 30 miles from downtown Los Angeles and can be reached from the Los Angeles International Airport via helicopter, by rented auto, or by limousine.

ADVANCE REGISTRATION

Please print complete address

NAME

TITLE

ORGANIZATION

STREET

CITY STATE ZIP CODE

Mail to:
Building Research Institute
1424 Sixteenth Street, N.W.
Washington, D. C. 20036

New members whose application and check for 1968 dues are received at or before the time of registration may register at the reduced BRI member rate.

SEMINAR FEE SCHEDULE

The registration fee for each seminar is $10.00 for BRI members and $15.00 for non-members. The Building Products Show luncheon on Tuesday, September 17, is $5.00 for anyone. The maximum number of seminars that can be attended by one person is four (4). The fee for four seminars is $40.00 for BRI members and $60.00 for non-members. Registrants may register for and attend as many or as few seminars as they choose, up to four.

Student registration—$2.00 per seminar.

☐ Check Enclosed
☐ I shall pay at Anaheim.

Note: No refunds can be made after September 1, 1968. No billing.

BUILDING RESEARCH INSTITUTE ANAHEIM SEMINARS

September 17-18-19, 1968

HOTEL/MOTEL RESERVATION APPLICATION

**Mail to: ANAHEIM VISITOR & CONVENTION BUREAU
800 West Katella Avenue
Anaheim, California 92802**

First night's deposit required per room. Make checks payable to: Housing Department, Anaheim Visitor & Convention Bureau

Please reserve ________ Single ________ Double (one bed) ________ Twin $________ Rate

Other (Specify) ________ Number in Party: Adult ( ) Children ( )

________ 1st Choice ________ 2nd Choice ________ 3rd Choice

An attempt will be made to make reservations at the Hotel or Motel of 1st choice. If rooms are all taken at the Hotel or Motel prior to receipt of reservation, we will try Hotel of 2nd choice, etc. **First night's deposit per room must accompany reservations unless otherwise noted. Do not send CASH. Deposit not refundable unless hotel notified 5 days prior to scheduled arrival.**

I (we) will arrive ________ Date at ________ A.M. P.M. and depart ________ P.M. A.M.

By Auto ☐ Rail ☐ Plane ☐ Bus ☐

Rooms requested above will be occupied by:

________ Signed

________ Address

BUILDING SCIENCE NEWS

Supplement: April-June 1968

(Left to Right) **Ben H. Evans AIA,** *Executive Vice President of the Building Research Institute;* **Glen Beckman,** *President of Industry Productions of America,* **Don R. Jacobsen,** *Show Chairman, and* **Dailey Mayo,** *Sales Manager, McGraw-Dodge of Los Angeles meet to discuss arrangements.*

The Board of Directors of the Building Research Institute has authorized a series of technical seminars, to be conducted in conjunction with the Annual Building Products Show in Anaheim, California on September 17-18-19, 1968. The Building Products Show is presented by Industry Productions of America and is expected to attract some 5000 to 8000 building industry people from the fourteen state area surrounding Los Angeles.

BRI will conduct a series of six seminars on such diverse subjects as "Energy and Lighting as Elements of Building Design," "Roof Bonds," "Joint Sealants," "Precast and Preassembled Concrete Systems" and "Glass in Building Design." The seminars, running concurrently with the Building Products Show, will begin the afternoon of September 17 and end at noon on September 19. Internationally famous Canadian architect John B. Parkin will be the keynote speaker at the annual Building Products Show luncheon.

The BRI seminars and the Building Products Show will be held at the new Anaheim Convention Center adjacent to fabulous Disneyland. The Convention Center is one of the finest facilities of its kind in the country and will provide a superb setting for the industry meetings. Numerous recreational opportunities in the surrounding area provide further enjoyment for participants and makes this meeting particularly attractive as a family affair.

At a recent meeting, Dan R. Jacobsen, Show Chairman and past president, Producers' Council, Southern California chapter; Dailey Mayo, Sales Manager, McGraw-Dodge, Los Angeles; Glen Beckman, president, Industry Productions of America and Ben H. Evans, Executive Vice President of Building Research Institute completed last minute arrangement details. Glen Beckman has announced that with BRI's agreement to hold the seminars concurrently requests for exihibit space at the Building Products Show have increased substantially. Over 200 companies are expected to exhibit their products.

"This will be the first time that BRI has participated in this kind of a grass-roots, elbow-rubbing technical session on a regional level," said BRI president, Gershon Meckler. "We are looking forward to the opportunity to carry BRI's capacities to the West Coast and to make new friends." Meckler urged that BRI members from the entire country make plans to attend the Anaheim sessions, to participate in this very worthwhile effort to engage in discussions on various technical and scientific subjects and to bring the "good news" of BRI activities to the West Coast building industry community.

Firms interested in exhibit space should contact Industry Productions of America, Union Bank Square, Suite 1625, 5th and Figueroa Streets, Los Angeles, California 90017. Further details on the BRI seminars, will be forthcoming within the next few weeks. (See opposite page for registration and hotel information.) All BRI members and other interested industry persons are welcome.

Anaheim Convention Center, *800 West Katella Avenue, Anaheim, California; a $15,000,000 multi-purpose complex of meeting and exhibition facilities.*

Building Research

The journal of building science, dedicated to the advancement of the science and technology of building

VOLUME 5, NUMBER 2

APRIL-JUNE 1968

IN THE NEXT ISSUE . . .

The July-September issue of BUILDING RESEARCH will contain selected technical papers from recent BRI Conferences.

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Building Science News

Benjamin H. Evans Appointed New BRI Executive Vice President

Benjamin H. Evans, AIA, has been named Executive Vice President of the Building Research Institute. The appointment, which became effective May 1, was announced by BRI President Gershon Meckler following a meeting of the BRI Board of Directors on April 22.

Evans has been an elected Vice President of the Institute since January 1. In his new position he succeeds Robert P. Darlington, AIA, who served as Executive Vice President in an acting capacity from January 1 through April 30. Darlington has joined the staff of the Copper Development Association in New York City as Manager of Market Development for Building Construction.

Evans comes to his new position from the staff of the American Institute of Architects where he has served as Director of Education and Research Programs since 1963. In accepting his new position, he stated that he looks forward to his association with BRI and to what he termed its "whole new program of vigorous activities under the new BRI 'image'." He also referred to a statement by President Meckler which emphasized the Institute's "unique ability to develop a broad interdisciplinary approach to research and innovation."

Active in BRI affairs for over ten years, Evans is also a member of the Building Research Advisory Board of the National Academy of Sciences, and of the Association of Collegiate Schools of Architecture and its Committee on Graduate Studies and Research. He is a Past President of the Brazos, Texas, Chapter of the AIA.

Evans

He holds a Master of Architecture degree from the A&M College of Texas where he served from 1958 to 1963 as Head of the Architectural Research Program. He has an extensive background in research dealing with environmental factors, air movement, lighting, and acoustics. This, together with his work in physical education shelters, thin shell construction, plastics, and other areas provides a unique set of qualifications for his new position with BRI.

Evans was an invited participant in the 1965 Nobel Memorial Tour of Sweden which included travel and study of Swedish educational and scientific institutions. While with AIA, he was closely associated with projects on the Cost of Architectural Services, Princeton Report and Implementation, Architectural Researchers Conference, and Emerging Techniques of Practice.

BRI Board Names New Vice President, Two New Members Chosen

At its meeting on April 22, the Board of Directors of the Building Research Institute named Leander Economides as Vice President. Economides, partner in the firm of Economides and Goldberg, Consulting Engineers, of New York City, replaces Benjamin H. Evans, AIA, who was appointed Executive Vice President of the Institute.

In other actions, the Board appointed two new members to fill existing vacancies. They are J. Anthony Vilar, a former BRI Executive Vice President, who is now Editor of BUILDING CONSTRUCTION magazine, Chicago, Illinois, and Robert W. McKinley, Manager, Technical Services, Glass Division, Pittsburgh Plate Glass Company, Pittsburgh, Pennsylvania.

R. P. Gerholz Wins Fitzpatrick Award

Robert P. Gerholz, President, Gerholz Community Homes, Inc., Flint, Michigan, and retiring Chairman of the Executive Committee of the Chamber of Commerce of the United States, has been awarded the 1968 F. Stuart Fitzpatrick Memorial Award for individual national achievement in the unificati of the construction industry.

The award, established in 1960 memory of F. Stuart Fitzpatrick, f many years manager of the Constru tion and Civil Development Departme of the National Chamber of Commerc is administered and supervised join by the Building Research Institute, t American Institute of Architects, t Associated General Contractors America, the National Association Home Builders, and the Produce Council, Inc.

Mr. Gerholz, the sixth recipient the award, was cited for his many yea of service to the construction indust and for his overall contribution to bu ness. He is a Past President of t National Chamber and of the Nation Association of Home Builders and t National Association of Real Esta Boards.

Institute Vice President Ben H. Eva represented BRI at the presentati which took place at a luncheon me ing of the National Chamber of Co merce on April 30. More than 1,5 people witnessed the presentation wh was followed by an address by Geor Ball, the new United States Ambassad to the United Nations.

BRI Gains 19 New Members

Seven professional firms and 12 dividuals have joined the Building search Institute since publication the January-March issue of BUILD RESEARCH.

New firms joining BRI include D Blosser & Associates, Raleigh, No Carolina; E. H. Brenner, AIA, Ar tect, Lafayette, Indiana; Dalton-Dal Associates, Cleveland, Ohio; M Knight, Kirmmse, French & Sizi Syracuse, New York; Sullam & Ae Architects, Seattle, Washington; S van & Associates, Architects, Rockvi Maryland; and WED Enterprises, I Glendale, California.

Individuals becoming members of Institute are H. C. Auerbach, Montr Canada; Stephen Kent Biggs, Washi ton, D.C.; John H. Burgee, AIA, York City; Herbert K. Enzmann, A Des Moines, Iowa; and Trygve W. H Cleveland, Ohio.

Also joining as individuals are Boulton Kelly, Jr., Baltimore, M land; G. R. Munger, New York C Magal H. Rao, Pittsburgh, Penn vania; Robert G. Sandvik, Arling Virginia; Stephen T. Spilos, Det Michigan; and J. Anthony Vilar, cago, Illinois.

nding BRI Conferences Programs usiastically Received

expanding activities of the Institute e been reflected in recent BRI Connces programming.

lo less than three Conferences have n held thus far in 1968, and all e made valuable contributions. The of the programs, on Totally Manuured Building Modules: The Case Instant Space, was held in Chicago March 27 and 28. Nearly 400 pers attended, and post-conference reon was enthusiastic.

he Spring Conferences were held in shington from April 23 through il 25. Programs were held on Innoon in Building Construction; The ce Building; Designing for the dicapped: Architecture for Every-; A New Look at Construction Seal-; and Floor-Ceiling Systems.

special interest group was repreed at the BRI Conference on Hous the Developing Nations, also held Vashington, on June 4 and 5. The re program, dealing with the role United States industry can play in ing to house less fortunate nations, recorded by the Voice of America possible use in its broadcasting vities.

Members in the News

ert G. H. Dietz, Professor of Build- Engineering, Department of Archiure, Massachusetts Institute of Techgy, has received a certificate of elec- to Honorary Membership in the erican Society for Testing and Mate-. The award was given "in recogni- of his outstanding and diverse conitions, both nationally and internally, to knowledge of materials building construction; for distinhed services in education, research, professional engineering; and for and faithful administrative and nical service to the society."

RI member firm *Giffels and Rosetti* the architect-engineer employed in design of the J. I. Case Company's transmission plant at Racine, Wisin. The Case Company is one of winners in the annual "Top Ten" manufacturing plants competition sored by FACTORY magazine. The ers were cited for their overall exnce in planning and production ities.

stitute member *Ralph J. Johnson*, Vice President, NAHB Research dation, received one of six 1968 st Products Industry Awards pred by the National Forest Products Association. He was cited for having "materially enhanced the reputation of the industry and for superior accomplishment in the finest traditions of the nation's oldest manufacturing industry." Johnson's paper on "Human Response to Residential Acoustical Environment" appears elsewhere in this issue of BUILDING RESEARCH.

BRI Board Member *James D. Piper*, Senior Vice President, Market Development, Portland Cement Association, has been awarded an honorary gold membership card by the Operative Plasterers' and Cement Masons' International Association in recognition of his longstanding interest in developing manpower for the concrete construction industry.

Ottawa, Washington to Host C.I.B.

The Fourth Triennial Congress of the International Council for Building Research Studies and Documentation (C.I.B.) will be held in Ottawa, Canada, and Washington, D. C., from October 9 through October 16.

Hosting the meetings will be the Full Members of the C.I.B. in the United States and Canada. BRI Representative to C.I.B. is Murray Silberman, Vice President, Intercontinental Corporation, Washington, D. C.

Principal subject of the Congress will be "World Building 1968—Cost and Quality." The Congress program will provide an opportunity for building specialists around the world to exchange views on new ideas in building science and technology. Congress sessions are open to all interested individuals.

A bulletin describing full details of the Congress is available from M. K. Ward, Secretary, Fourth C.I.B. Congress, c/o National Research Council, Ottawa 7, Canada.

R. Buckminster Fuller Receives First BRI Fellowship Award

R. Buckminster Fuller, pictured at right in the above photograph, is shown being presented with his Certificate of Fellowship in the Building Research Institute by BRI President Gershon Meckler during the Institute's Spring Conferences.

Fuller, designer of the original Dymaxion House, inventor of the geodesic dome, and designer of the United States Pavilion at Expo 67, is the first person to be invested as an Honorary Member and Fellow of the Institute.

The award was presented "in recognition of his countless innovations in building construction, his many outstanding contributions to the science and technology of building, and his stimulation of student and practitioner alike to face the constant challenge of improving our environment.

BRI Bylaws provide that Honorary Members shall be persons of eminence in the field of the Institute's interests, one of which is to explore the interdisciplinary character of the science of building and buildings.

In making the award, President Meckler noted that Fuller is "the personification of interdisciplinary innovation" who, "at the age of 73, has just reached the pinnacle of his influence."

Editor's Comment

SOCIETY HAS CHANGED at an exceedingly rapid rate in recent years. These rapid changes have brought about serious problems which the whole nation is striving to solve as quickly as possible. Confusion, frustration, and sometimes a touch of defeatism have at one time or another affected all of us. However, men of healthy mind and body have the capacity to bounce back, when the realization comes that, along with change and problems, go challenge and opportunity.

The Building Research Institute, too, has been affected by these rapid changes and the explosion of new activities in the building field. Sometimes it has responded positively and brilliantly, but too often BRI's activities have been less than sensational. Often we have created conferences which sparked a sensitive area of concern but often, too, conferences have only re-explored tired old criteria and subjects.

Things are changing. BRI is experiencing a new and fresh revitalization. BRI's Board of Directors has set for itself the task of reorienting the Institute so as to focus on the real needs of the building industry.

If I did not believe that BRI would and could do it, I would not have consented to join the team as Executive Vice President. I see a lot of action and I like what I see. BRI is going places—clear across the United States, and some day possibly beyond. Having devoted my life to research and education in the building field, I think that BRI has a significant role to play, that it is a unique one, and that I want to be part of it. Building research and technology needs a BRI.

During the self-analysis, debate, and resulting frustrations of these pas months, BRI members and Directors have struggled to define the Institute' role in the industry and in society. Out of that debate has emerged a cleare image of what we are and where we are going. The image is not yet fully developed, but it is taking shape and the shape is exciting.

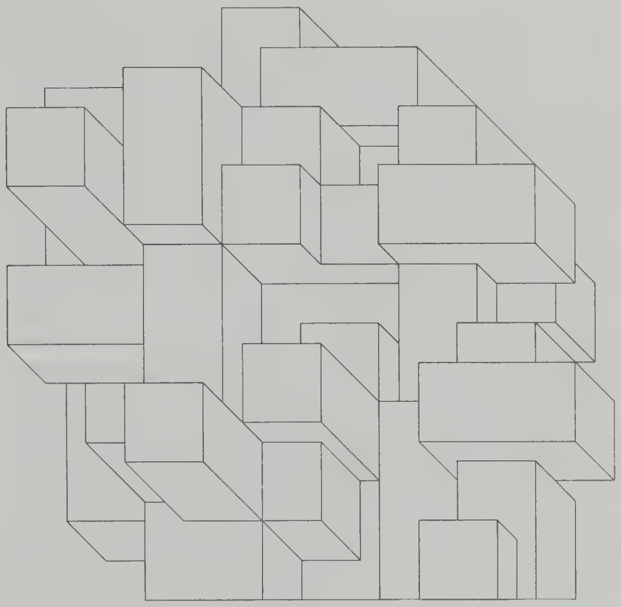
There were strong feelings and much interchange of ideas about last year' proposed "merger" with the Building Research Advisory Board (BRAB) Regardless of the possible advantages or disadvantages of such a merger the outcome of the debate has been made quite clear. BRI will remain a an independent organization—directed, supported, and manned by peopl from private enterprise. Nevertheless, the relationships that should exis between BRI and BRAB are many and they are significant. After all, BR came into being as a natural complement to BRAB which has as its objective to serve the building industry and to counsel the Federal Government These relationships are advantageous to all of us, and they can be strength ened without sacrificing either BRI's independence, BRAB's usefulness, o the industry's continuing efforts at cooperation and coordination. In comin issues of BUILDING RESEARCH I will attempt to present a clearer pictur of the Building Research Institute and its relationships with BRAB.

Like any organization, BRI is made up of people, and people are wha make things happen. We have fine people in BRI and I am confident tha *we*—you and I together—can create a vital and purposeful Building Researc Institute. I look forward to your comments, your suggestions, and your ful participation!

Benjamin H. Evan

Benjamin H. Evans, AIA
Executive Vice Presiden

Multi-Family Construction in the Urban Situation



This BRI interdisciplinary Conference was designed as an in-depth study of goals, techniques, and products which are destined to have an impact on the provision of improved multi-family housing in urban areas. These technical papers from the BRI 1967 Fall Conferences were selected from among those presented during the Conference on Multi-Family Construction in the Urban Situation. The program was presented jointly by BRI Technical Division II, Building Design, under the chairmanship of Arthur Deimel, AIA, Office of Construction, U.S. Office of Education, Department of Health, Education and Welfare; and BRI Technical Division IV, Building Systems, under the chairmanship of Dan E. Morgenroth, Manager, Technical Sales, Owens-Corning Fiberglas Corporation.

The Cliff Dweller Today

A BOOKISH FRIEND, more than 20 years out of college, still remembers a remarkable lecture given by his university librarian.

The librarian, citing indisputable facts and statistics about the number of volumes and the linear feet of shelf space then being added to libraries, "proved" in his lecture that the inevitable rate of expansion for libraries was bound to use up, by 1967, the entire developed land area of the United States. There was to be no more room for cities—just one gigantic library.

At the fantastic rate new books and pamphlets were being published, catalogued, and put on shelves shortly after World War II, a rate much faster than road building, airport development, bridge building, or housing construction, it was quite clear, this astute university librarian had pointed out, that libraries were taking over.

Soon, he argued with infallible logic, there would be no roads, airports, bridges, or houses and apartments left in the land. The convincing realism of that lecture left my friend dazed. He accepted the argument completely. In 1967 he finds himself greatly puzzled because the prediction has not come to pass, but the logic, as he remembers it, was irresistible.

This example is quite relevant in contemplating the "infallible" logic of the proposition offered here: that apartments will have to house most Americans at the beginning of the 21st Century and that, in so doing, they should not obliterate the landscape.

This proposition is not meant to be a statistical trick. It is valid. The evidence for it is appearing all over the country.

Changing Housing Trends

Those who grew up in smaller cities and towns, almost any place where apartments were unknown or a rarity a generation or a decade ago, will have observed significant changes recently.

The quarter-, half-, one-, or two-acre holdouts in our classic suburban zoning battles gradually are being outnumbered. The "cliff dweller" of today will become, and will have to become, the new pace setter in modern urban living. Modern urban living is no longer restricted to city environments. At the same time, city environments will endure.

The one simple idea behind this hypothesis is that, with more people, less space, and fewer locational choices, it is necessary to find new ways to combine greater density with greater livability and to achieve the national objectives of "a decent home and a suitable living environment for every American family." Multi-family construction is the obvious course.

Within the cities, the inevitable trend is "up." Despite the forebodings of the planners, and despite the continuing controversy about its height, an extra-high high-rise Pan Am Building was erected right in the middle of Manhattan. A towering (or, perhaps, overtowering, or overpowering) World Trade Center will be built there, too. Both, according to some critics, are too ugly and too high, but that is not the point. The point is that both are there.

At the same time, the continuing push still is "out." During the 1950's the suburban population grew about three times as much as the central city population. Multi-family construction, both "up" and "out," grows apace.

Multi-family housing construction (five or more units per structure) is expected to grow from about 12 percent during the 1950's to something like 40 percent of all housing units to be constructed in the next decade. This 40 percent, in the 1970's, will represent 40 percent of 2 to 2.5 million housing starts, or something approaching a million units a year. After that, even more units can be expected.

Because of this, speculation about the future of cliff dwellers in this country is in order.

Reactions to Change

A grocery store owner from Sea Bright, on the New Jersey Coast, longing for the "good old days," described his reaction last year to a journalist: "It's the same all down the shore—apartments, apartments, apartments."

This store owner was talking about recent changes in the beach communities that stretch up the Atlantic coast to Sandy Hook. He voiced a common observation: "Our sewerage plant can't handle the load. One of those nine-story apartment jobs is booked for the site—a condominium."

This kind of reaction has just begun to make a real impression on our national consciousness. It reflects the inevitable course of the trend toward forced urbanization and it prescribes, in large part, the future for the American "Cliff Dweller Today."

ROBERT E. McCABE, Deputy Assistant Secretary for Renewal Assistance, Department of Housing and Urban Development, Washington, D. C.

The apartment appears to be well on its way to becoming our national home. The single family homeseeker is perplexed. The American heritage of a mule and 160 acres for each returning veteran has been relegated to history.

There is a discernible new national housing trend, aptly described as "The New Apartment Community." This is not the blind-date haven for young "singles" which has received such a great deal of news publicity recently, but the much more comprehensive development of making urban, suburban, exurban, and almost-rural apartment projects so attractive to the confirmed single-family homeowner that he will give up his subdivision house and move right in. This development appears to have been a very logical reaction to many urban land use problems. However, "The New Apartment Community" is strictly for the self-supporting middle and upper classes.

Glover Landing in Marblehead, Massachusetts; The Meadows in San Rafael, California; and the Watergate project in Washington, D. C., are among the many "New Apartment Community" developments. All include more than just the well-known swimming pools.

These are, for the most part, projects with private apartment entrances, shops, complete community centers, marina facilities, and with architecture and design that attempts to leave the character of the land largely unchanged.

The intent is to bring all the advantages of the modern apartment building to a unique setting, and to provide nearly all of the amenities of an idealized suburbia, as well as the amenities of real urban living, to any location.

Census Bureau estimates indicate that the central city share of annual apartment construction in 1966 was only 41 percent, while 49 percent was in suburban areas, and another 10 percent was completely outside metropolitan areas, some located in small towns and some in the country.

A really major shift can be seen toward bringing the city to the country, and vice versa. This is a shift that, with intelligent planning, design, and architecture, need not involve, and may even become a significant counterweight to, the unplanned sprawl and "slurb" developments that have been so universally deplored over the past few decades.

The answer to the inadequate sewerage plant in Sea Bright, of course, is not the negative complaint of the local grocer, but the necessary and inevitable provision of this kind of public facility on a publicly-planned basis. It is not possible to bury one's head in the beach-sand and simply ignore the population push.

One of the most fascinating recent responses to the challenge of this population push is the "New Town" concept, already tried in Reston, Virginia, and now being pursued in Columbia, Maryland. (See BUILDING RESEARCH, Vol. 2, No. 1, January-February, 1966.)

Although Americans have not yet really approached the development of "New Towns" in the way the British and Scandinavians have, the essential idea of our most promising "New Towns" is similar: a positive approach toward the overall planning, design, and development of an area to meet unprecedented population pressures.

A completely different kind of "New Town" concept, incidentally, is being incorporated in the "New Town-In Town" proposals that the U.S. Department of Housing and Urban Development is developing with a number of cities to make use of surplus Federal land *within* the major cities for communities of the kind now being developed for the National Training School site in Washington, D. C.

The Expanding Population

It is not necessary to dramatize the population push. It only need be emphasized that it represents a problem which must be met head-on, not only through major city high-rise developments and air rights, "New Apartment Communities," "New Towns," "New Town-In Town" proposals, or urban renewal projects for the central city, but through every conceivable device and new idea for housing.

The United States has already passed the 200 million mark in total population, and that 200 million is expected to increase by another 136 million in the next 1½ generations.

It will be necessary to accommodate as many more people in this country in the next 30-odd years as represented the entire population of the United States just a little more than a single generation ago.

The individual can grasp this concept by counting his own children, or those of his neighbor, and stopping to speculate just how and where they will be housed when each of them is raising a family.

On the national scene, one soon comes up against the startling realization that before the beginning of the 21st Century we shall have to build as much as has been built in our entire history, since the first settlers landed in Virginia and Massachusetts. Just to meet this population push we shall have to double our so-called urban physical plant. This, by itself, is a challenge to apartment builders.

The New Jersey sewerage plant, of course, is part of the total urban physical plant that will have to be doubled. And so is the condominium. More accurately, these are parts of the doubling that already is well under way.

Both are directly related to the major responsibilities and interests of the urban renewal program of HUD's Renewal Assistance Administration. Both are of major concern to the entire Department of Housing and Urban Development. Those in HUD, just as much as those in the construction industry, are trying to learn from our past and present experience. However, it is becoming increasingly difficult to maintain discrete differentiations between the established "urban" and "rural" definitions and the ever-growing range of categories that fall somewhere between. The trite cliché that "times are changing" is not enough to explain this difficulty.

Just about one-tenth of the total land area, including the wide-open spaces of the Far West and the far stretches of Alaska, is already given over to what are described as the "Standard Metropolitan Statistical Areas." It is true that still only one percent of the land area is completely urbanized in the sense that it is covered by continuous development, but the 10 percent figure is significant. It includes the counties, by county line, surrounding each central city complex. Near the District of Columbia, Montgomery and Prince Georges County, surrounding Washington, bump up against Howard and Anne Arundel County, surrounding Baltimore. This pattern is familiar all over the country.

The vacant land suitable for urban development, in terms of location and condition, is being used up. The pattern is not a hard and crystallized one, however. "Much of this urban setting is no more than a sandcastle," Barbara Ward wrote in a recent world-wide assessment of cities for three billion more people. The modern city does not represent any image of a congealed and settled urban landscape.

Not everyone, of course, has seen the condominiums going up on the Jersey Coast, or on the Delaware and Maryland Coasts in Rehoboth and Ocean City, or even right on the harborfronts of Chesapeake Bay. But the fact, just as with the Pan Am Building, is that they are there.

And the point, to put it differently, no longer is whether apartments must be built inside the city, but rather whether the city and its values, or urban livability, can be built into the apartment project, wherever it is located.

After a recognition of these fundamentals: the tremendous population growth, the very limited land available to accommodate it, and the spillover effect into the countryside, it would seem that there are four principal and closely related considerations in the future of American multi-family construction—the geographic, the economic, the social, and the technological.

The Geographic Consideration

The geographic consideration includes, of course, the question of whether to build in the city or the country, and where. It covers the topographic, scenic, locational choice, and it involves the availability of transportation facilities, the latest changes in commuter habits, and the growth patterns of the metropolitan areas.

As part of the geographic consideration, mainly influenced by the private car and the expressway, a balance is apparent between the accessibility of downtown, and the infusion of more and more "downtown-type" urban amenities and values in the multi-family project, gradually changing in favor of the latter. Location in and of itself, in other words, no longer determines livability.

This represents the increasing amount of total community development, and "New Town" building, going up outside the older central cities, and it also reflects an awareness by builders that the organizational size and the financing behind an apartment development often may give it a competitive advantage over the single-family house in offering urban and urbane luxuries in a suburban or exurban setting.

Thus, under the geographic consideration, there exists all over the country a similar kind of locational determination pattern: a geographic ebb and flow of locational choices. These are representative of what has taken place in the Washington area over the last few decades where, particularly in the last decade, there has been a remarkable trend of putting up multi-family buildings beyond the immediate suburbs. At the same time, there has been a remarkable surge of central city renewal efforts.

In sum, the geographic consideration is an intown-suburban-exurban-intown cycle that accompanies the expansion of the metropolitan area during the gradual obliteration of traditional urban definitions.

To put it very simply, the stage has been reached where "it's all on one map." There is probably no better example than a recent oil company's road map for the Washington area on which, in a remarkable break with tradition, Washington and Baltimore, Rockville and Annapolis, Reston and Columbia, Dulles and Friendship airports, are shown on one map on which the merging cities and the country are no longer given separate, but new and equal treatment.

The Economic Consideration

The major economic issue is an exceedingly difficult one. This is the question of how much high-rise, low-rent public housing to build, how soon, in what part of the most highly-developed urban area, and what are the alternatives available?

It encompasses the double difficulty of tenants who may never have had modern facilities and utilities, and who, while they appreciate the plumbing, also are keenly aware that they have to live in prison-like buildings without any of the urban amenities and urban features that have been described. They are separated from the rest of the city's society because public cost limitations will not permit more than the minimum of necessary elevators, bathroom fixtures, and heating. In short, must projects provide *only* shelter? What are the economic alternatives?

While high-rise buildings in low-income public housing projects are better than no decent housing at all, this question of their economic utility leads to some broader social considerations.

Most enlightened students seem to agree that high-rise buildings themselves are not to blame for the lack of livability in public housing projects, but rather the overconcentration of high-rise buildings, without the amenities of livability, in one single location. This means, then, that the only sensible solution is to scatter the public housing, and scattering of public housing sites invariably brings the social questions to a head.

The Social Consideration

Under the social consideration falls the major public challenge of our urban situation. It is all very well to point to the staggering array of amenities that can be built today into a "New Apartment Community" or a "New Town" which may, indeed, be located almost anywhere in the country.

However, the greatest national need is for much more, and much more adequate, low and moderate-income housing, not necessarily idyllic developments, but good enough to give the occupants the essential feeling of "community."

And since the people who need this housing are in the cities, it is in the cities, in all likelihood, that such housing must be built. The "New Town-In Town" proposals that have been mentioned are just one more effort to come to grips with this challenge.

Professor Robert Katz, in a paper presented at a Building Research Institute Conference several years ago (BUILDING RESEARCH, Vol. 1, No. 1, January-February 1964) came to the conclusion that there is no fixed relationship between livability and density, that "skillful designers can build excellent housing at densities substantially higher than the accepted maximums of a few years ago." The city, in other words, can be made to work.

Barbara Ward also was keenly aware of this point when she wrote that the city offers richness of choice and variety only if citizens have access to them, and she described the high-rise low-income housing issue as one of the "prisons of resentment." She wrote that "cities built only to work and sleep in—drab, uniform, continuous, without parks and swimming pools—become prisons of resentment."

We must, at one and the same time, recognize, endorse and understand the implications of the building trend of our times, to provide for new apartment dwellers a successful combination of a sense of privacy with a sense of community in the many new types of apartment developments, both outside and inside the central cities. This trend, unfortunately, so far has bypassed the most critical national housing problem—the desperate need for low and moderate income housing for underprivileged city dwellers.

U.S. Education Commissioner Harold Howe gave a dramatic "dream" example that might well help to meet this need. He suggested a combination of public and private funds, harnessing the profit motive, to build 60-story structures in our largest cities, with business offices, schools, cultural and recreational facilities, and apartments of all kinds, all under one roof, and all integrated in every respect, economically, socially, and functionally.

Instead of having bus drivers transport them, parents could take their own children to school, as they could go to their own offices, in the same skyscraper, or they could send them off to school, from their apartments, in the elevator. Children of bankers, dentists, secretaries, butchers, and elevator operators all would go to school in the same place.

Thus the schools, as well as the downtown city areas, would not, as they do now, turn into blacked-out warehouses and ghost towns from 5 o'clock in the afternoon until 9 in the morning.

Although presented as a dream, this suggestion already is being planned in a New York City experiment. Only through imaginative and dramatic innovations of this kind shall we be able to attack this problem.

Technological Change

Technological innovation, in particular, deserves a separate mention. The technological consideration well may be the key to the future. A major technological point is represented in HABITAT, Moshe Safdie's work at EXPO 67. This is a possible technological breakthrough that may provide some of the answers for the geographic, economic, social, and physical aspects of the future of American apartment building. The dazzling innovation Mr. Safdie has achieved with HABITAT is to pull the values of the suburb back *into* the city. This remarkable achievement combines truly urban housing with suburban amenities and an assembly-line production of identical building blocks.

The success of HABITAT partly is based on the very sound idea, which Mr. Safdie credits to Buckminster Fuller, that living standards are linked to mass production. As the *New York Times* put it, "Just about every housing and building rule, precedent, practice, custom, and convention, is broken by HABITAT . . . but . . . the importance of the concept for housing design and production cannot be overstated. Both the puzzle and the promise of the future is in this housing."

Mr. Safdie's principal point seems to be that "we must ask what it is about the suburbs people want, then give it to them in the city." This is the obverse of what is now going on in so many new American communities where apartment developers have found that what people want in the city also, within limits, can be given to them in the suburbs or in the country.

Implications for the Future

The lesson to be gained from all this is no more than that perhaps the greater density required in America's cities will not be at all as incompatible with the very much greater livability that must be attained, but this is more than any can yet clearly foresee.

Indeed, it is certain that most Americans at the beginning of the 21st Century will have to be housed in apartments. However, just as librarians, no matter how astute, could not foresee 20 years ago what kinds of microfilming, electronic computers, automatic data retrieval systems, or similar technological innovations might prevent the complete and inevitable take-over of all built-up civilization by the billions of acres of library shelves which some of them then were forecasting, just so cannot builders, developers, or urban technologists today foresee whether the American "Cliff Dweller" of tomorrow is necessarily stuck in an unlivable cliff. ☐

Mr. McCabe is a member of the National Association of Housing and Redevelopment Officials. He received his B.A. from Central Michigan College and his M.A. in Sociology and M.A. in Planning from the University of Chicago. He has received the Housing and Home Finance Agency's Distinguished Service Award.

Local Government Outlook on Multi-Family Construction

Much of the subject of multi-family housing is not really new to most people in the building fields but, within the 4½ million person Detroit metropolitan region, it is. There is a very recent trend in that part of the midwest toward construction of more multi-family housing of all types.

Multi-family housing, in the strict sense of the word, consists of two or more separate housing units in a single building. However, the definition of "multi-family" housing is limited here to apartments and other variations which are made up of three or more separate units in the same building.

In Detroit, and probably in most other urban areas, two of the key factors influencing location and construction of multi-family housing are appropriate land use and economic feasibility. Beyond this, it would seem

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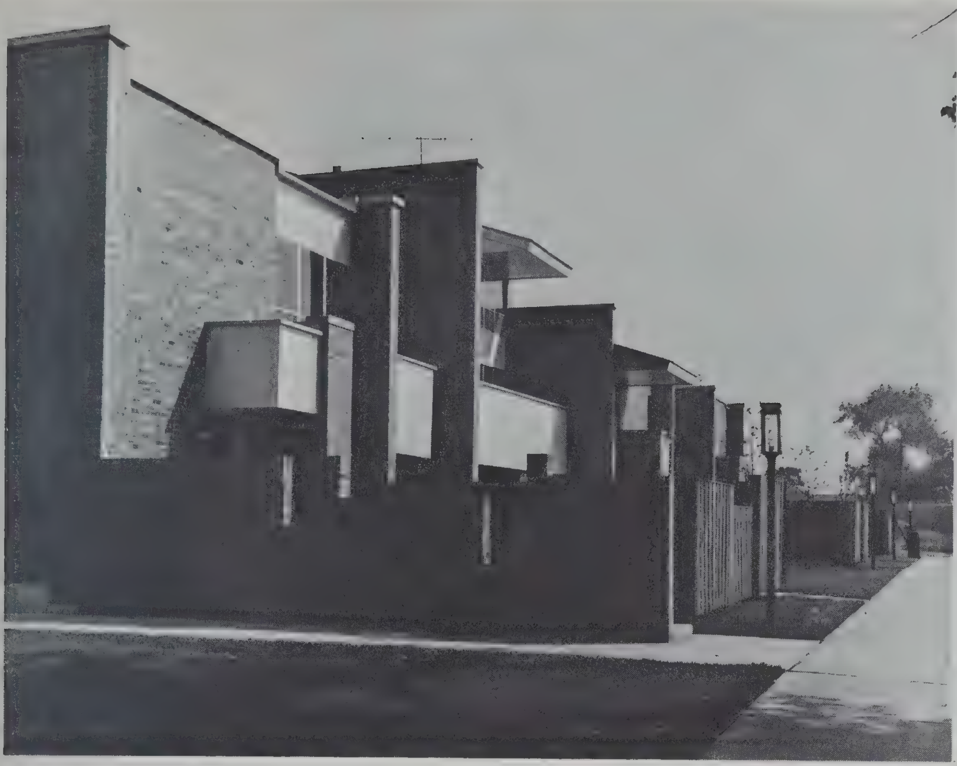
ROBERT D. KNOX, Director-Secretary, Detroit Housing Commission, Detroit, Michigan.



Winner of several design awards, these Park North apartments in the Elmwood Park renewal area are being built in 11-unit groupings, each with walled interior courtyards. A total of 180 units are planned.

that local governments (in the central cities at least) are rather broad-minded in their attitudes about this type of residential construction. In other words, if the builder's piece fits into the city planner's urban puzzle and has economic feasibility, the builder needs only to obtain financing.

Lafayette Park

A specific example can be cited. In Detroit's Lafayette Park renewal area, near the downtown, about 2,500 units of new housing have been built since 1956. All of these are in multi-family developments of one type or other.

Every one of the 13 developers who has built in Lafayette Park already had the two key factors of appropriate land use and economic feasibility operating in his favor because of the nature of the urban renewal project.

After urban renewal clearance, the Lafayette Park area was completely devoid of inappropriate land uses such as large commercial or industrial buildings. This is a common fault in many older urban residential areas. The area is bounded on all four sides by natural buffers consisting of two major streets, a railroad line, and a freeway. Lafayette Park is within walking distance of the central business district, and this is the most frequently mentioned reason why people have moved into downtown area housing.

The third factor in multi-family housing construction, financing, was the only great problem. Most of the first 13 developers to build in Lafayette Park have experienced depressingly long waits for federal loan commitments. However, there have also been long waits for the city government which, despite criticism between progress reports, has supported these private developers who have been patient partners with government in urban renewal.

The Travel Factor

Urban renewal is only one contributing aspect of the trend toward more multi-family housing. A more basic reason for this trend, particularly in the Detroit area, is the availability of land in terms of proximity to employment. Although there are hundreds of square miles of buildable land in southeast Michigan, there is a limit to how far people will travel from home to work.

Consequently, more people are being housed per square mile than ever before, and in more multi-family housing than many suburban sub-dividers ever thought possible. Today, building extends upward as well as outward.

All of this, of necessity, has made multi-family housing more practical and desirable. For the past two decades, the construction of single family homes in sprawling subdivisions has been Detroit's and America's most noted residential pattern. This pattern could not have continued without causing an even more serious housing shortage than presently exists. Simply speaking, it takes too much land and too much initial investment to build only single family dwellings.

A portion of residential development in Detroit's Lafayette Park renewal neighborhood. The three high-rise buildings are (left to right): Pavilion Apartments, 340 units; Four Freedoms House, 320 Senior Citizens Apartments; and 1300 Lafayette East, 366 units. A central park and shopping center are integral elements in this complete new inner city area.

Until and unless some form of unfaltering, uncongested mass transportation is developed, new housing will have to be less horizontal and more vertical.

In the meantime, a housing shortage exists. In Detroit and other Michigan urban areas, the waiting lists for private and public housing are longer than they have been since World War II when there were shortages of every kind. The market for new housing at all income levels continues to swell.

It is hardly surprising that there is such a variety of reasons for the swelling housing market. At one end of the scale, there are the nouveau riche in quest of multi-level estates with curved driveways. At the other end are the rehoused and remortgaged slum dwellers who are satisfied if there is only a little more green space between the front door and the curb. Demand for new and good used housing of all types is rising because there simply are more people and more new households forming

Community Renewal Program

This latter observation is explained further in a study done as part of the Detroit Community Renewal Program (CRP). In the CRP's Population and Housing Study (Technical Report No. 11, August 1965) it is noted that there were more occupied dwelling units in the City of Detroit in 1960 than ten years before, even though population dropped by ten percent. This was attributed to a rapid increase in the number of small families in the city having their own homes or apartments, as opposed to families living with relatives or other families.

An even more significant factor, of course, is the large number of post-World War II babies who are now marrying and requiring homes of their own.

With the increased demand has come the greatest variety of new ideas in sales and rental housing, and ways by which to finance it, that this country has ever seen. These include court apartments, tri-levels, townhouses, towers, terraces and dozens more. The array of residential architecture is fascinating and diverse. It is very likely that there will be an even greater variety of new housing types and designs, especially if the supply ever begins to approach demand levels.

Why has supply become such a serious problem? In Detroit, it is mainly a result of the fact that there are

Table 1

TOTAL ANNUAL RESIDENTIAL CONSTRUCTION (PERMIT-AUTHORIZED UNITS[1])

Year	Detroit	Three-County Detroit Metro Area
1966	1,478	24,386
1965	1,877	32,025
1964	2,321	25,599
1963	2,197	21,849
1962	3,129	18,914

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[1] Sources: Detroit Metropolitan Regional Plan Commission; U.S. Department of Commerce

more people, and the building industry has not been able to keep up with the overall demand, particularly for lower cost units. As a matter of fact, Table 1 reveals that there has been a downturn in new housing starts in the Detroit area during the last few years.

The bulk of new residential construction continues to occur in the metropolitan area, with very few single-family units being built in the central city because of limited land availability. The City of Detroit's share of new residential construction has been mostly multi-family housing. In terms of percentage, from two to three times as much apartment housing has been built in the central city than in the metropolitan area. This is reflected in Table 2.

Table 2

ANNUAL APARTMENT CONSTRUCTION
(PERCENT OF TOTAL RESIDENTIAL UNITS BUILT[1])

Year	Detroit	Three-County Detroit Metro Area
1966	1,181	9,942
	(80)	(40)
1965	1,511	12,315
	(80)	(42)
1964	1,868	8,221
	(80)	(32)
1963	1,665	6,061
	(76)	(28)
1962	2,322	4,439
	(74)	(23)

[1] Source: Detroit Metro Area Regional Plan Commission

Factors Peculiar to Detroit

There is much to be said about Detroit's residential apartment construction. For one thing, it is an indicator of a fairly constant demand for convenience living in convenience places; namely, the central city. Second, it is a reflection of how new housing within the city must be supplied, considering limited land availability.

Also, and in answer to critics who say that Detroit residents are being bulldozed into the suburbs, despite all the freeway and urban renewal clearance of the last decade, more housing units are being built than are being demolished. Since 1956, 17,793 units have been removed and 23,039 new units built within the City of Detroit.

It is interesting to note that a very sizeable part of the 9,000 apartments built in the city within the last five years are in the downtown business district or nearby. In Lafayette Park, nearly 2,500 apartments have been completed and leased or sold.

Multi-Family Market Aspects

Since downtown area housing has been and will continue to be largely multi-family, it might be useful at this point to list some aspects of this market, as reported in a study of downtown housing demands recently completed for the Detroit Housing Commission (Downtown Housing Demands, April 1966).

Nearness to downtown Detroit is a dominant selling point for all apartment developers who have purchased urban renewal sites. This is the central square within the Regency Square apartment development. There are 85 rental units in the project.

Of the people who have moved into the downtown area, 24 percent have incomes above $20,000 a year and 25 percent earn between $12,000 and $20,000. Higher income residents have strong preferences for two and three bedroom units. Efficiency apartments comprise one-fourth of all downtown housing and are preferred by elderly, one-person families.

The need for a separate dining room and a second bathroom is not as essential among downtown apartment dwellers as it is among families moving into suburban housing.

A good view from the living room window is one of the most important competitive advantages, especially in high-rise apartment buildings.

Private rentals dominate the multi-family housing developments in the downtown area. In Lafayette Park, 80 percent of the new housing units are rentals. The balance are cooperatives or condominiums.

Downtown area apartments command a higher proportion of the $200 a month and up rentals than do suburban area apartments (41 percent vs. only six percent in the suburbs). Demand for apartments in the Detroit metropolitan area is now estimated at 10,000 per year, with the downtown area absorbing as much as one-fifth of all new apartment construction.

These are but a few of the more salient features of the downtown housing market which has developed since urban renewal and the clearance of the former slums in Lafayette Park.

It is, as many citizens of Detroit are aware, the success of Lafayette Park with its diverse arrangement of living accommodations that has led to much of the apartment building within the downtown area since 1960. Since the Lafayette Park venture, the city's urban renewal program has been heralded as one of the best in the country. So it is that construction in the nearby Elmwood Park renewal area has not been long in quickening its pace.

Nearly 700 cooperative and condominium units, most in garden-type clusters and courts, are being built now in the first phase of Elmwood Park. One of the developers, building 98 condominium units, sold its entire 50 unit first section before it was completed. This should be encouraging to developers who hope to build in the later phases of this renewal project.

Also in the first phase of Elmwood Park, a planned 200 unit high-rise for senior citizens will be built as soon as financing is completed. To be built by the Young Israel Corporation, it will be the third Section 202 senior citizen housing development in a Detroit renewal project. Section 202 housing was financed through the Federal Community Facilities Administration and now through the Housing Assistance Administration (HAA). Two other senior citizen developments, Four Freedoms House with 320 units and Rochdale Court with 70 units, are in Lafayette Park. Much of the new public housing in Detroit has come about because of the increasing elderly population and the need for housing this group.

Housing Senior Citizens

Detroit has the bulk of the 15,000 units of public housing built or planned in 30 cities in Michigan, and the elderly are by far the largest tenant group. Detroit's senior citizens rent close to half of all the available public housing, and hundreds more are on the waiting list. Consequently, eight of the ten new sites selected for public housing in the past year will be utilized for construction of senior citizen apartments. Public housing, for the most part, is and will continue to be built in multi-family structures, though with less density than in the past.

Another type of multi-family housing which is popular among the lower income groups is the 221d3, an FHA program for non-profit sponsors which carries a three percent, 40-year mortgage maximum.

In the Detroit area, about 2,000 221d3 units have been built, and there are at least 30 different local organizations interested in sponsoring this type of housing development. Now that additional rent supplement funds are hopefully being put into the federal coffers, more families earning below $6,000 and $7,000 a year will be able to afford this type of housing.

Public housing, 202 and 221d3 housing are some of the types which will help ease the shortage at the lower income levels. Many more varieties will be needed, however. There is also much talk about the possible construction of pre-fabricated units which may be within reach of this segment of the housing market.

Problems of Supply

The supply of low income housing available in older areas of the central city is being reduced. This is because, slowly but surely, big city tenements and the like are being bulldozed away along with other urban slums. Where the slum dwellers will live in the future is a perplexing problem for everyone. Meeting the urgent need for low income housing is, perhaps, the most formidable challenge facing government and the building industry.

Over five million people will be living in the Detroit area by 1980, according to population estimates. An additional 500,000 housing units will be needed, at least one fourth of these in multi-family dwellings. Therefore, the pace of residential building must increase, and soon. Otherwise, an even tighter urban housing squeeze will develop during the balance of this century.

Yet, there is sufficient reason for optimism that urban area housing is only facing a temporary dilemma. The resources of the building industry, combined with the expanding role of government each year, provide a sound basis for this optimism. Finally, there can be little doubt that multi-family housing construction will become a much more common part of the urban setting. ☐

Mr. Knox is a member of the National Association of Housing and Redevelopment Officials, the Detroit Metropolitan Area Regional Plan Commission, and the United Northwestern Realty Association of Detroit. He received his B.A. in Economics from Michigan State University.

Investor-Manager Company in Multi-Family Housing

RECENT CORPORATE DIVERSIFICATION has resulted in the entry of several large industrial companies into real estate as investor/managers. Experience has shown that great promise for the rebuilding of blighted areas of America's urban centers lies in this trend. At the same time, however, the promise is clouded by problems of inadequate planning and complexities of Federal, State, and Local legislation, regulation, and attitudes related to construction, financing and taxing of multi-family housing in urban redevelopment programs. After almost seven years of participation in real estate, Alcoa Residences, Inc., has drawn some firm conclusions and formulated some dogmatic opinions about corporate involvement in the future of urban renewal and multi-family housing.

Venture Into Urban Redevelopment

The venture into urban redevelopment described here began in 1960. Our original decision was to seek two dramatic locations on which to construct high-rise buildings designed to demonstrate the proper architectural uses of aluminum. Our initial and limited objective of two show places was soon expanded into full-scale participation in high-rise construction, both commercial and residential, in a number of cities. We did not change course abruptly, but circumstances indicated quickly enough that our organization was in a unique position in which to participate profitably in the rebuilding of a number of important American cities and to contribute ideas and stability to the urban redevelopment movement.

Our status in this new area of urban redevelopment was accelerated from that of visitor to full-time resident by the inability of some of our original partners to meet their share of the financial commitments involved in our jointly-sponsored projects. More and more, circumstances maneuvered our organization into a controlling position in the projects, and into the role of developer and manager of properties in addition to our original role of financier. We currently own and operate projects in six major urban areas: New York City, Philadelphia,

VAUGHN R. CHASE, President, Alcoa Residences, Inc., New York, New York.

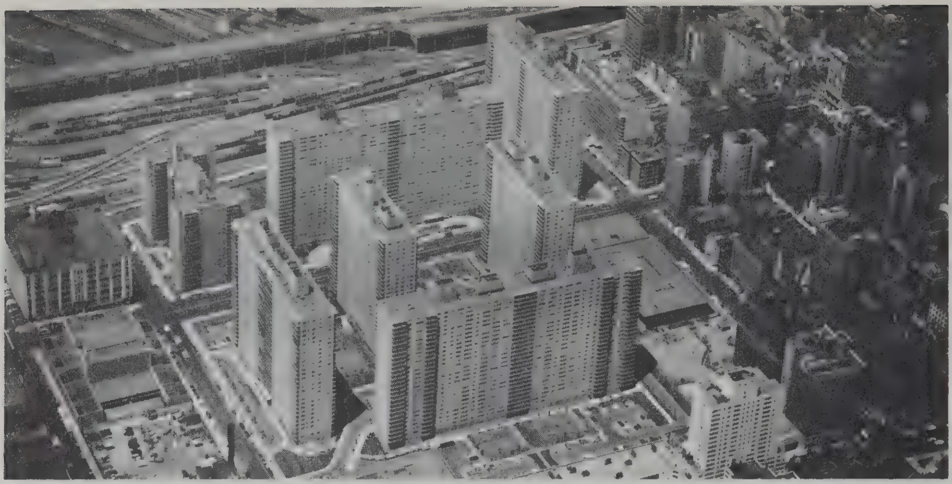

Figure 1. Lincoln Towers.

Pittsburgh, Indianapolis, San Francisco and Los Angeles. Our properties in New York are Lincoln Towers, Kips Bay Plaza, and Park West Village. They are shown in Figures 1 through 3. The current inventory of company-wide properties consists of over 12,000 apartments, 1,250,000 sq ft of office space, and 1,290,000 sq ft of shopping center space. Presently under construction or planned are an additional 563 apartments, 538,000 sq ft of office space, and 319,000 sq ft of shopping center space.

At the end of 1966, ten projects owned by the company in these six cities had a gross asset value of approximately $434,000,000. The long-term liabilities on these assets totaled some $412,955,000.

For our company, which had been primarily concerned with producing and fabricating aluminum products, this venture has been something akin to that of a youngster who has found a new swimming hole and has taken a plunge. The first splash was exhilarating, the challenge of reaching the far shore and success stimulating. We continue to be exhilarated and stimulated by the business of owning and managing properties. However, we also have now geared ourselves for the long and strenuous effort that will be required to reach the other shore and success, in this case profit.

Guiding Philosophy and Goals

Some comment on our reasons for taking this plunge, our guiding philosophy, and our goals, is in order.

We are not in business, either aluminum or real estate, to make a fast dollar. We have an abiding interest in the renewal of major urban areas which are so vital to this society in which we work and live, and we are completely candid about the fact that it delights us to create and capitalize on every opportunity offered for the use of aluminum. Foremost, however, we are in real estate to make money. We would be less than honest if we did not profess this intention and we would be derelict in our responsibility to shareholders if it were not our intention. Our basic philosophy may be simply stated. We know that in the aluminum business we can make a fair return for shareholders year after year only by giving value received to our customers. We believe that the same basic philosophy works in urban redevelopment. We have accomplished little unless and until people want to work and live in our properties.

We have concluded that financial strength and stability is essential for those who would venture into the world of real estate. The investor/manager must have the strength to carry properties through the construction and early rental stages when substantial losses are inevitable, and beyond that until an advantageous opportunity to sell is developed. A company, for example, whose annual earnings are predominantly derived from other business can charge off financing costs during building construction, operating losses during the rental period, and depreciation once the properties are in operation. This means the cash drain on a company in a position similar to ours is about half what it would be for a developer who had no other business. It becomes fairly obvious that the investor/manager must of necessity view his role as a long-term venture. This is an essential requirement.

The Seed Money Concept

The seed money concept of financing a redevelopment is not a smooth-sailing panacea for developer and seeder alike. Urban redevelopment would have better acceptance, and in the long run would make faster progress, if more adequate financing were insisted upon before redevelopment contracts were awarded. The seed money concept ignores the consequences of construction delays and a variety of unanticipated costs which nearly always develop. It is like starting a business with credit already exhausted and no working capital, only more so. The inevitable result of skimpy financing is that the project will have less chance of success. Or, if it does succeed on this tenuous basis, managerial services may have to be curtailed with dissatisfied tenants as a result. Our experience with seed money has been relatively painless, but we have seen enough to know that we have had our fill of it.

Another conclusion we have reached is that corporate investment of this nature is good not only for the com-

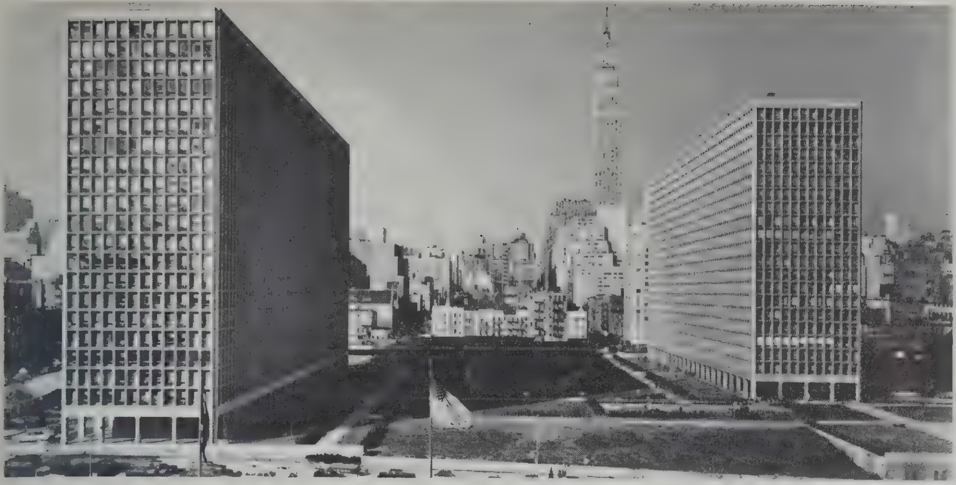

Figure 2. Kips Bay Plaza.

pany, but for the urban redevelopment program in general. Along with providing investment opportunity, potential product applications, and corporate diversification, investment in multi-family housing projects provides an outlet for a corporation to satisfy the desire that most progressive companies share today: to make a positive contribution to society. If, with our investment, we can anticipate improving the appearance, living conditions, and general economic value of an urban area, and provide a place for thousands of our fellow Americans to live at reasonable price, then we shall be doubly rewarded.

The next conclusions are logical sequels. First, money and management go together. It will seldom work to any satisfactory degree to put money into multi-family housing projects without accompanying the investment of dollars with the equally important investment of management personnel. We think this practice ought to be carried a step further to the point that the owner should assume direct responsibility for the planning, construction and management of its projects. This is fundamental if the owner is to manage with a long-term view. The project can be successful only if it is planned, built, maintained and managed properly. This can be accomplished in the way the owner desires only if all of these functions are supervised directly from the point of conception by the owner's staff.

The final conclusion is really a point of caution. The notion that properties are worthwhile simply to display an abundance of the sponsor's products may have some supporters, but we are not among them. There is no question that a relationship exists between our role as investor/manager and our interest as a supplier, but the total value of any one company's products used in a high-rise apartment building does not produce sufficient profits to justify the risk involved in total capital invested.

Some Problems

The most persistent and perplexing problem we face relates to our primary objective: that of how to generate a profit or even cash on an investment in multi-family housing.

There are other reasons why one cannot expect to make a fast dollar in this business. Long-term investment requires a minimum of about eight years from conception through design, construction, rental, and on to a high percentage of occupancy for a multi-family high-rise apartment project. A farsighted manager might reply, "I can be patient for an investment to pay off."

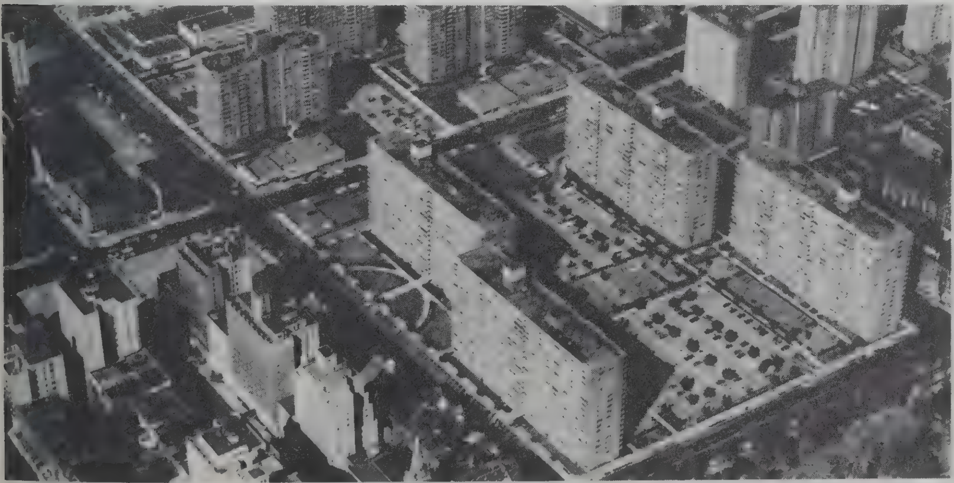

Figure 3. Park West Village.

However, what does one have to look forward to at the end of the eight-year period? Our Lincoln Towers project in New York City, involving 3,850 apartments, is at that point. In New York, operating, maintenance, payroll, administrative, and management expenses account for 30.1% of the total revenue which would be received if all units were fully occupied and producing income at the present rates. On the same income basis, real estate taxes account for another 23.7%. Debt service takes another 42.7%. After these expenses, not much is left. The figure is 3.5%, and this must cover vacancy losses and comprise the cash flow on a capital investment on all three properties in New York of $163,000,000. Our projections for 1969 are that our free and clear return before depreciation will have increased to something just under 5.5%. That should amply support the case for preparing for a long-range effort and results which are, admittedly quite moderate.

These figures and comments refer directly to the New York properties, and not to the standing of our total real estate properties. Of the $163,000,000 capitalized cost in New York, $138,100,000 was financed by means of first mortgages, and the balance of $24,900,000 represents equity capital invested by Alcoa and predecessor owners to complete the development of the projects. This equity will have been increased by an estimated additional $12,500,000 to cover the operating losses of the projects through mid-1968, when they are expected to reach a cash break-even point.

Problems of Taxation

One of the reasons why there is a problem of generating cash is the understandable alacrity with which municipal tax assessors add a newly completed building or project to the tax rolls at the full rate. Most companies fully intend to pay their fair share of local taxes but, while owners are willing to go that far, they do not wish to go beyond that point. This becomes more than a matter of principle. It involves the prospects of success or failure, when a project that is far below a cash break-even point is burdened with a full tax load. As much as municipalities need additional tax revenue, it must be considered that early and heavy property taxation will in the long run defeat the urban renewal concept and the hoped-for improvement of the municipal tax base.

Taxes, in the early stages as well as in the case of a fully occupied project, often mean the difference between profit and loss. One solution would be for local tax authorities to consider granting a tax abatement proportionate to the number of vacancies in a new project. It is difficult to understand why tax abatements are granted on projects financed or owned by cities and states, but not on those financed under FHA insured mortgages, or conventionally, as an inducement to build much-needed additional housing.

Of Alcoa's total liability figure of almost $413,000,000, about 40% is in FHA mortgages. Nearly 90% of the FHA commitment on the properties is involved in the three properties in New York.

FHA Financing

With that as background, it can be noted that one of our nagging doubts concerns the efficacy of FHA financing. It is difficult to make this assertion without seeming to be critical of the FHA. On the contrary, it is doing a good and necessary job; many projects would never be considered or completed without FHA financing. However, FHA is dealing with public funds and operating under statutory limitations. This makes it unlikely that the flexibility and constructive features of well-conceived private financing means could ever be matched by FHA. Adding to the problem are delays and loss of control of the timing of a project, frustration, and often additional expenses. Recently, it took one year to obtain much-needed increases in rent ceilings on the New York properties.

The reason for this was that FHA requirements for information are made available piece-meal and not in any published summary of FHA regulations. The details of the method used by FHA to compute rent ceilings are a deep secret and not available to owners. A constructive change would come about if some provision were to be made for informing the developer more fully of the regulations and restrictions which apply to his project.

Granting the necessity of FHA funds to urban redevelopment, we nevertheless intend in any future investment in high-rise construction to finance in most instance via private or conventional channels, simply to maintain the control and flexibility we need and to eliminate delays and red tape to the greatest degree possible.

Satisfaction and Accomplishments

Turning to the more positive aspects of our experience, there is much satisfaction to be gained, and accomplishments that may be attained in even a relatively short period. For example, we feel some sense of accomplishment in the fact that our New York projects, which are now completed, are nearly 100% filled. We have, in addition, already achieved a profitable operation with our garages and commercial space. We have significantly improved the condition of the properties from what it was when we assumed full control. This cost money, of course, but the effort appears to be reaping its return in the form of good renting activity. We are now very close to the point at which we will be able to operate without requiring additional cash to cover operating losses.

Industrial corporations can make a contribution to the development of our urban areas and to the availability of multi-family housing, and generate a return for their shareholders, if good sense in planning and financing are observed, and if problems of taxation and government regulation can be resolved or moderated. ☐

Mr. Chase holds a Fellowship in the National Institute of Credit. He is a member of the Real Estate Board of New York, the Realty Foundation, the Lincoln Square Neighborhood Center, and the East Side Association. He received his B.S. in Business Administration from the Ohio State University.

Rental Cost Factors in Multi-Family Housing

OVER 40 PERCENT OF CONSTRUCTION in the coming decade will be multi-family. To provide good housing requires a detailed understanding of what people expect from their housing. "Better living" does not happen automatically. It takes extensive planning. This planning requires conscientious attention to hundreds of details, whether this "better living" is interpreted in terms of contemporary, colonial, or provincial motif, or in tower or townhouse dwellings.

What must be done is to accurately incorporate what people want into developments that they can afford. In a real sense, people do not rent apartments. Instead, they take a lease on a way of life.

There are advantages to single family living, as well as to apartment living, and both can be economically combined into a manner of living that is better than

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WALTER SCOTT HAYNES, President, Multicon Management Company, Columbus, Ohio.

Table 1

MONTHLY RENTAL VALUE OF APARTMENT AMENITIES

Added Feature	Monthly Rental Value
Private patio	$ 8.00 - 10.00
Balcony on second floor	3.00 - 4.00
Carpet throughout, two bedroom unit	10.00 - 13.00
Basement, unfurnished	7.00 - 10.00
Dishwasher	3.00 - 5.00
Swimming pool	10.00
Activity center (billiards, ping pong)	3.00 - 5.00
Night watchman	1.00 - 3.00
Gate house or impressive entrance	3.00
Draperies furnished	5.00 - 6.00

either separately. To create this "best of both worlds," it takes a team of professionals skilled in creating these values at a price people can afford. Multi-family housing is unique in one very important way. The real work comes after the sale is made. This implies that the owner's relationship with the customer only begins with the sale. In home sales, on the other hand, the relationship ends with the sale just as it does in the case of automobiles, appliances, food, clothing, and the like. This is exactly why good operation and management of the apartment community is the key to financial success. Sincere and friendly management can actually overcome design mistakes such as insufficient parking facilities or lack of adequate space.

Value of Attractive Features

It is quite possible to design and build a nearly perfect apartment project, but it is difficult to do it at a price that enough people can afford so as to be able to rent the units as fast as they are completed. Certain features and amenities are worth assignable amounts in garden apartments geared to satisfy those earning over $12,000 annually. The monthly rental values of some worthwhile features are shown in Table 1. This is an effort to translate the increasing demands for a better way of life into practical realities. Developers make decisions every day in order to provide their residents with something they can enjoy at prices within their means.

Table 2

OPERATING EXPENSES BY DOLLAR AND PERCENT OF ANNUAL INCOME FOR 16,000 APARTMENTS

	All Buildings		Buildings built since 1961	
	$ Room Year	% of Income	$ Room Year	% of Income
Total payroll expenses	$ 26.14	7.7%	$ 22.58	5.4%
Management	13.95	4.1	16.07	3.8
Other administrative costs	5.91	1.8	8.00	1.9
Painting and decorating	8.26	2.4	7.21	1.7
Maintenance and repairs	13.74	4.0	12.09	2.9
Supplies	2.08	.6	2.62	.6
Services	3.13	.9	4.19	1.0
Miscellaneous operating expenses	3.87	1.1	5.12	1.3
	$ 77.08	22.6%	$ 77.88	18.6%
Insurance	5.23	1.5	6.60	1.6
Taxes, except real estate	3.18	1.0	5.84	1.4
Utilities (heat, electricity, water)	35.62	10.0	43.60	10.3
	$121.11	35.1%	$133.92	31.9%

Controlable Maintenance Expenses

It is not just enough to build in a fine array of amenities. Real pleasure in apartment community living is a result of prompt, effective maintenance and management service. However, it is important to relate this to the economics of "better living." To do this, let us consider the expenses.

Since real estate taxes take from 10 to 15 percent of the gross possible income, and debt service takes another 40 to 50 percent, this leaves a balance of from 35 to 50 percent for operating expense and profit. Maintenance, management and administration will ordinarily run between 32 and 40 percent of income.

In a study made by the Institute of Real Estate Management of nearly 16,000 apartments, that part of the income dollar available for providing the services amounts to about 35 percent for garden type apartments. This is broken down in Table 2.

Consumer Research As a Guide In Design

The problem that confronts the industry is to invest in those products and services that people really desire. From an economic analysis of the desires of middle income residents, it is possible to conclude that a successful apartment community must be planned around the physical and mental recreation needs of the residents. In addition, the day-to-day inconveniences of home living must be reduced to the minimum as society learns to live more closely together. Some of these inconveniences are disturbing sounds from nearby neighbors, cooking odors, inconvenient parking, inadequate storage, complex or unattractive trash disposal methods, fear of personal safety, and invasions of privacy, real or imaginary.

Conclusion

Because there is a strong natural trend to multi-family living, all of those involved in producing the environment for "better living" must develop practical new methods, materials, and plans to enhance this living condition as populations expand and densities increase. The opportunities for all to help meet this challenge are great. ☐

Mr. Haynes holds a B.S. in Metallurgical Engineering from Purdue University.

Prefabrication of Large Three-Dimensional Units for High-Rise Housing

THIS REPORT IS A REVIEW of research investigations carried out by Trygve Hoff & Associates under the auspices of the American Iron and Steel Institute through its High-Rise Buildings Subcommittee of the Committee on Building Research and Technology. The purpose was to investigate and develop new methods of design and construction of high-rise buildings that will effectively and economically utilize structural steel.

Within this general field the researchers were not restricted in any way, the emphasis being placed on the formulation of unique approaches which have not previously been explored. In short, the purpose was to develop new ideas, rather than to evaluate old ideas.

Following a review of existing technical literature, a basic architectural plan for a prototype high-rise apartment building was developed. This served to establish a specific and reasonable dimensional pattern upon which to base the design, while at the same time allowing considerable flexibility for architectural variations. While the ideas were not to be confined to one particular building, it was felt essential that the scheme be carried out rather completely for a specific structure so as to insure completeness of design and provide a basis for calculation of the unit weight of structural framing. The prototype building is shown in Figure 1.

At subsequent staff meetings it was decided to direct major attention toward the maximum utilization of prefabrication. Accordingly, the proposed scheme of shipping prefabricated units evolved from early study, and the major share of time and effort was devoted to the analysis of the structural system and the development of workable connection details.

Proposed Method of Construction

In design of the structural frame, shop prefabrication was extensively utilized. Shipping units, one-story high, one bay wide, and as long as the least dimension of the building, are fabricated in the shop or on the ground at the site, and then stacked in place and field welded together to form the frame of the building. Each shipping unit includes the floor deck for two floors and all of the floor beams, struts, columns and bracing members contained within its geometric boundaries. The one-story high units are staggered in adjoining bays so that columns are furnished alternately by the bays on either side of a given column row. A shipping unit is shown in Figure 2.

Structural tubing has been used to achieve compactness, easy handling, and maximum section efficiency for compression members. The only exceptions are the transverse floor beams and the bottom chord members. Angles are used as bottom chords, except on the exterior walls, to provide a nesting effect where the two bottom chord members rest upon the top chord tubes of the prefabricated units in the adjoining bays of the next lower story. Columns and bracing members will be furnished as loose members on alternate stories of the exterior walls that run parallel to the length of the shipping units.

Wind bracing will be provided in the two corridor walls and in the two end walls of the building. This gives the architect considerable flexibility in apartment layout and window placement on the longer exterior walls.

A specific design for the floor deck has not been developed since it would not affect the basic frame design. It has been assumed, however, that the floor will be either a metal deck or a sandwich type unit which, either by itself or in conjunction with added

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TRYGVE W. HOFF, Chairman of the Board of Directors, Trygve Hoff & Associates, Engineers, Cleveland, Ohio.

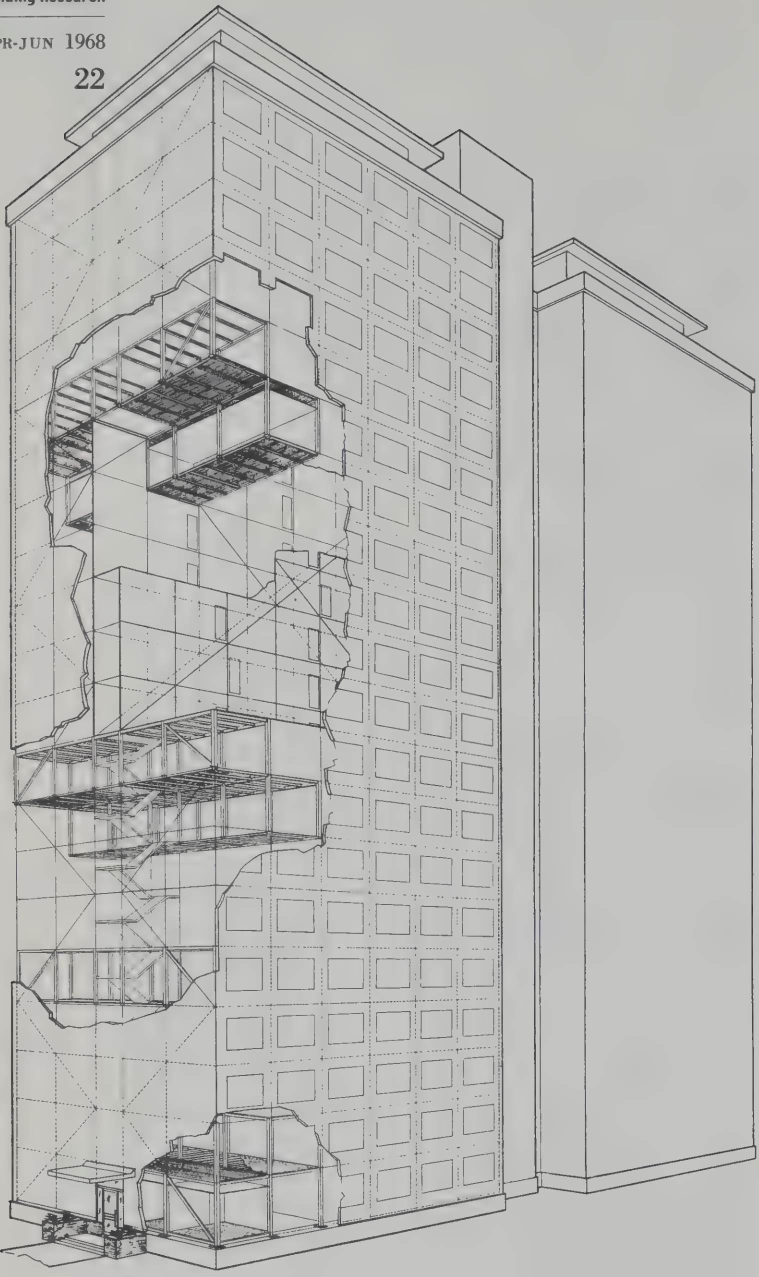

Figure 1. Perspective view of high rise apartment building shows internal bracing, internal partitions, and structural shipping units.

insulation materials, will provide satisfactory thermal and acoustic insulation. Furthermore, the floor deck will be welded to its supports, thereby providing sufficient diaphragm stiffness to distribute horizontal loads at each floor to the bracing planes.

As each unit is erected, the bottom chords will be field welded to the members on which they rest. Such welding will be nominal except at the joints of the transverse vertical bracing, where the bracing forces must be transferred directly from one unit to the next. The transfer of vertical loads from unit to unit is accomplished in direct compression through the base angle furnished as part of the bottom chord of each unit. When the size of the column changes, the base angle must be sufficiently thick to provide for such transition in section.

The three-dimensional aspect of the shipping units suggests the extension of prefabrication to include the installation of partitions, plumbing, heating and ventilating ductwork, electrical wiring and various fixtures. However, any such additions must not interfere with the fit-up clearances required for erection and must permit easy access to all field welded joints.

During fabrication, shipping, and erection the prefabricated units must be properly supported to prevent distortion of the frame. The basic framing requires that at all times a support be furnished at each of the twelve vertical columns, either by blocking from below or by hanging from above. Thus, any lifting device must be connected to the frame near each of the column tops. For example, two lifting beams (each 56 ft long) could be used with six hangers from each; or with two suspension points on each lifting beam, a light 14 in. section would be more than adequate as the lifting beam.

In order to speed up the handling and erection of the units, a handling jig could be rigidly attached to the unit at the time of fabrication. Such a jig could be left in place until the unit is in its final erected position in the building, and then returned in an empty carrier for placement on another unit.

An alternate method of providing the necessary shipping and erection stiffness would be to install temporary bracing between the top and bottom chord members of the unit so as to form a space frame capable of being picked up with two or four point suspension. The mass production and multiple use of such handling devices would reduce their cost to a relatively small factor.

The structural analysis of the framing system is a direct procedure, since all lateral forces are carried to the foundation through the four vertical bracing planes.

Heating, cooling, plumbing and electrical service have been considered in the arrangement of the building and the structural framing system. It has been assumed that a hung ceiling will permit concealment of pipe, conduit and ductwork, the ceiling being lower in the corridor than in the apartment. Pipe chase openings can be left in the floor panels as required.

Evaluation

The value of the proposed scheme depends upon the practical realization of the potential efficiencies in fabrication and erection. Further study and consultation with fabricators and erectors is necessary before an accurate assessment can be made of the fabrication, shipping, and erection costs.

Certainly, considerable economy can be achieved through shop fabrication, on an assembly-line basis, of the many repetitive shipping units involved in such construction. The prototype 20-story building will require 60 shipping units. Erection costs of the steel frame and floor system should be relatively inexpensive.

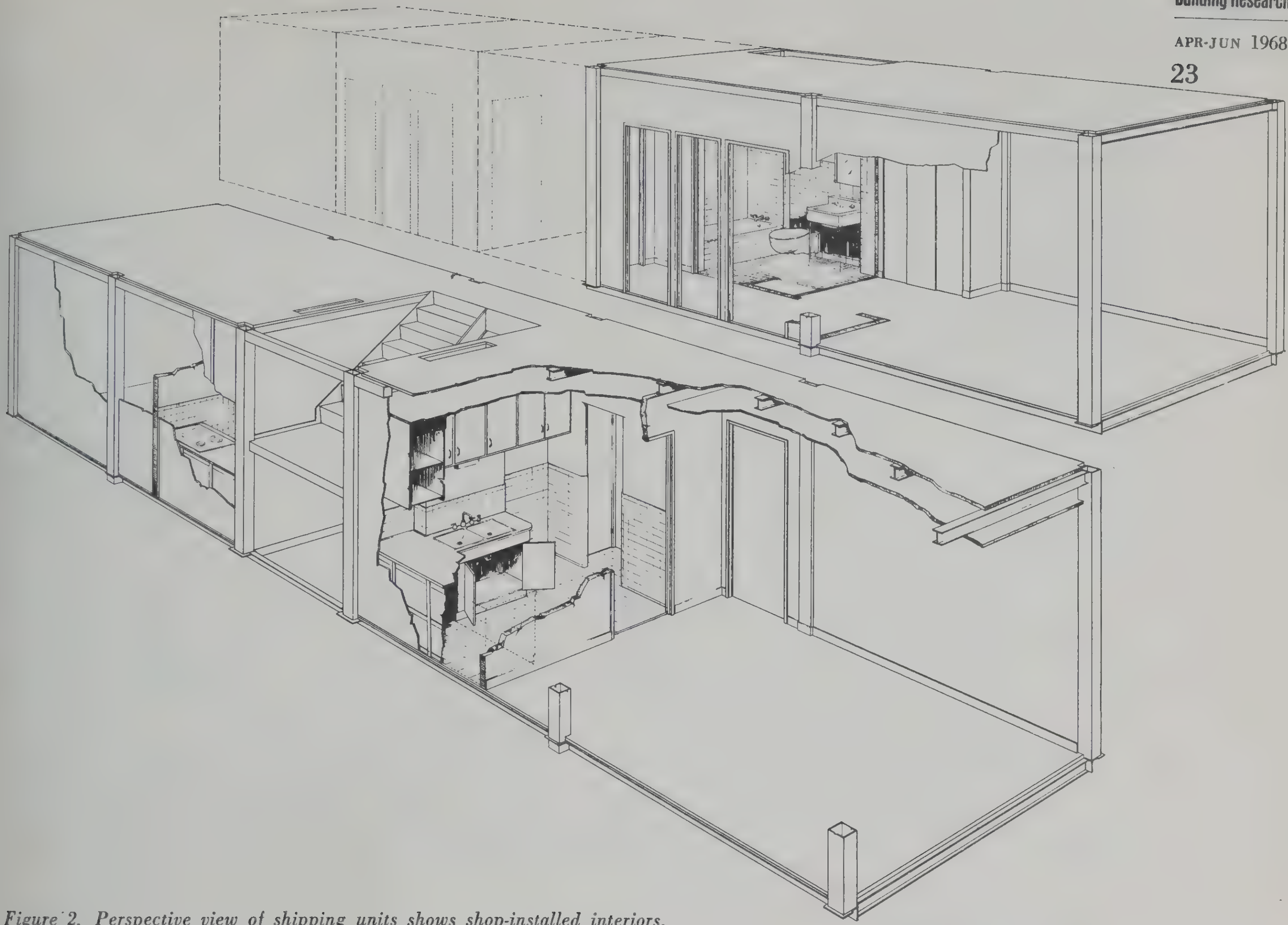

Figure 2. Perspective view of shipping units shows shop-installed interiors.

On the other hand, the cost of handling and shipping the units may be a major factor. Because of the volumetric size of the units and possible limitations of site storage area, transportation must be organized efficiently in order to minimize the number of times a unit is handled. Much will depend on the development of an economical handling arrangement, either by temporarily bracing the space frame or by using lifting beams.

The computed structural weight of the prototype building, 6.12 psf, is less than the usual unit weight figures for structural shapes and open web joist construction buildings of comparable size.

Because the mill price of structural tubing entails a premium price over that of structural shapes, a direct comparison of weight per sq ft is not valid in terms of cost. To compensate for this price differential, the weight of the tubing can be multiplied by an adjustment factor to give a weight per sq ft figure that is comparable on a mill price basis with a building framed entirely of A-36 steel. The resulting adjusted weight is 7.22 psf.

Within the limits of the designated column spacing pattern, the architect can express a reasonable degree of flexibility in apartment layout. Furthermore, the basic principle of large shipping units can be applied to innumerable variations on the basic column pattern.

Conclusions

The proposed scheme offers significant opportunities for reducing the cost of constructing high-rise apartment buildings. The weight of steel involved is slightly lower than that of conventional construction, but current premium prices for tubular shapes will somewhat offset this advantage. Fabrication and erection costs should be lower than in ordinary construction, and are dependent upon the development and utilization of efficient production techniques.

Handling and shipping arrangements need to be carefully controlled to avoid excessive costs. Opportunities for prefabrication within the shipping units of interior fixtures, partitions, and service elements could further reduce the cost of the finished building. Further study of handling and erection procedures and costs is recommended. □

Mr. Hoff is a member of the American Society of Civil Engineers, the Ohio Society of Professional Engineers; the Cleveland Engineering Society, and the Consulting Engineers Council. He is a Registered Engineer in New Jersey and Ohio. He attended Columbia University, the Carnegie Institute of Technology, and Cornell University, and he holds a degree in Civil Engineering from Cornell University.

Comparative Study of Residential Medium-Rise Structures

THIS RESEARCH PROJECT attempted to determine whether there are several alternate solutions to cast-in-place concrete commonly used in the construction of six story apartment buildings. The research included a study of current building systems, including concrete. Any type of construction was included that was felt would satisfy the requirements of the various interested public agencies in New York City.

Procedure

Several alternatives were investigated, developed and evaluated from economic, life safety, structural and aesthetic points of view. To simplify the comparison, a basic building design for a housing unit was chosen. It was a project designed for the City of New York in 1961 called Baychester Housing. It was chosen because it is a characteristic six story, medium rise concrete residential building complex. The procedure attempted to develop a building type of a quality, character and functional organization at least equal to that of the original Baychester Project.

PAUL SILVER, Senior Associate, Design Department
Gruzen & Partners, Architects, New York, New York.

Five alternate approaches were considered, in addition to the original Baychester solution. Scheme "A," shown in Figure 1, is the original project which used a conventional concrete frame and a brick cavity wall exterior. The interior partitions were plaster, but for the purpose of this research project, dry wall partitions were substituted. This was done to provide a more accurate basis of comparison with the other alternatives, which used dry wall partitions. Several other similar changes were made, all of which were intended to reduce to a minimum the number of extraneous variables which would complicate the problem. A few of the substitutions were chosen because they are in common use now and it was felt they would lower the cost of the buildings, therefore providing a better basis for comparison with the original Baychester Project.

The next approach studied, Scheme "B," used steel beams, bar joists and angle strut columns. The exterior wall was again a brick cavity system. The floor decking was 2 in. gypsum plank. This scheme is shown in Figure 2. The third approach, Scheme "C," also employed steel beams and angle strut columns, but instead of a joist and gypsum plank system, a 6 in. deep concrete plank was substituted. The exterior wall was again a cavity wall system. Figure 3 illustrates this approach.

Scheme "D," shown in Figure 4, is similar to Scheme "B" insofar as it used steel beams, bar joists and gypsum plank, but the exterior and corridor walls are load-bearing masonry in lieu of a cavity system.

The next approach, Scheme "E," combines the 6 in. concrete plank and the load bearing masonry walls. This scheme used a few steel members to support the ends of the long span planks, but is otherwise almost entirely without the use of steel. It is illustrated in Figure 5.

The sixth and final approach, called Scheme "F," deviated considerably from the standard construction of apartment houses. It combines modern component assembly techniques with industrial materials. Scheme "F" is shown in Figure 6.

The building structure of Scheme "F" consists of steel channels, tees and angle strut columns supporting a corrugated metal decking. The decking in turn supports a layer of plywood which is glued and mechanically fastened to the decking. The exterior wall is composed of insulated steel panels which include the window elements. This system was by far the most significant deviation from the familiar type of residential construction and the character of the exterior is therefore noticeably affected. This fact must be recognized if a valid comparison of the various systems is to follow. The other five systems, for the most part, maintain the exterior character of the original design.

The interior partitions for Scheme "F" were organized on a modular basis. However, the plan organization of the Baychester Project was maintained and the original building form unaltered. The approach of Scheme "F" markedly differs from the former ones by being a system using dry components suitable to partial factory assembly. The building could, in fact, be erected very much in the manner in which automobiles are built. Such a building could be put together from component

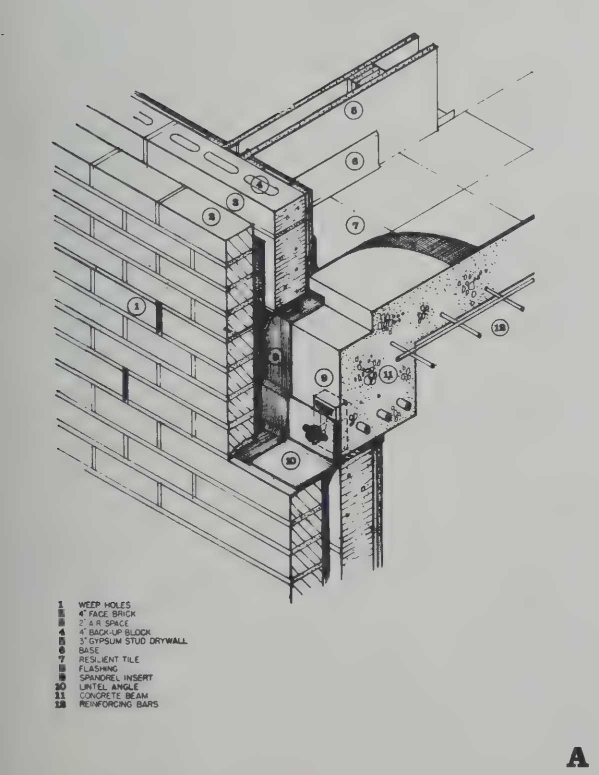

Figure 1. Scheme "A."

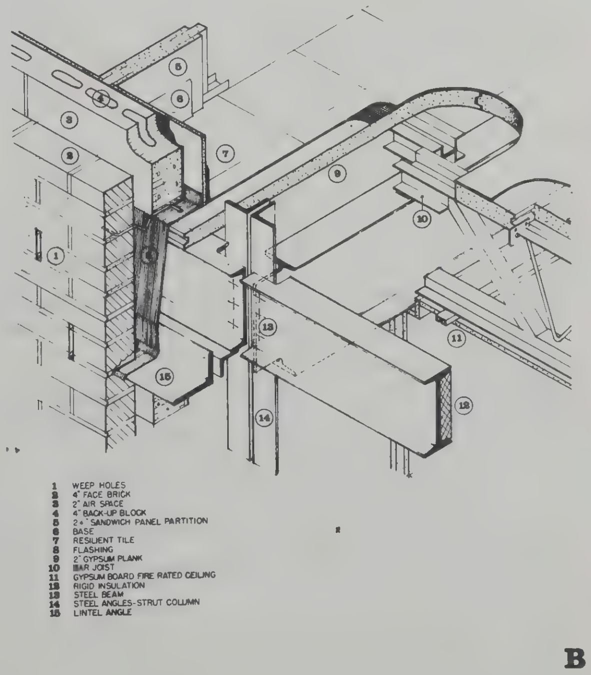

Figure 2. Scheme "B."

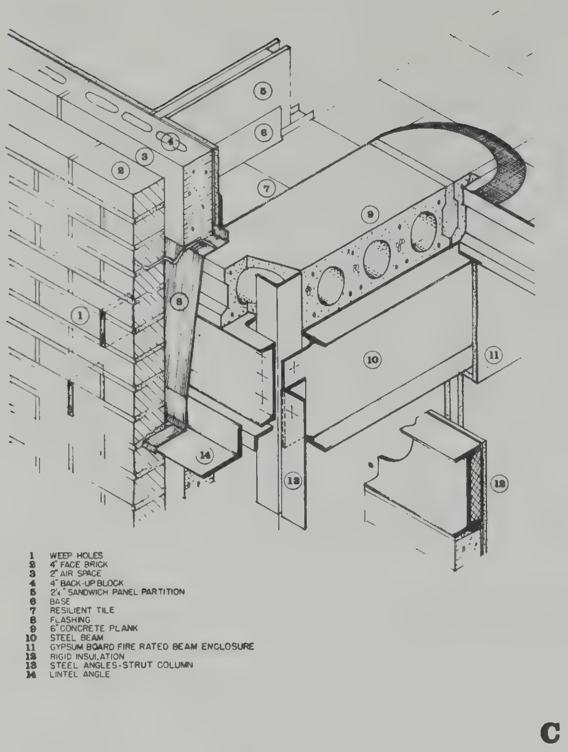

Figure 3. Scheme "C."

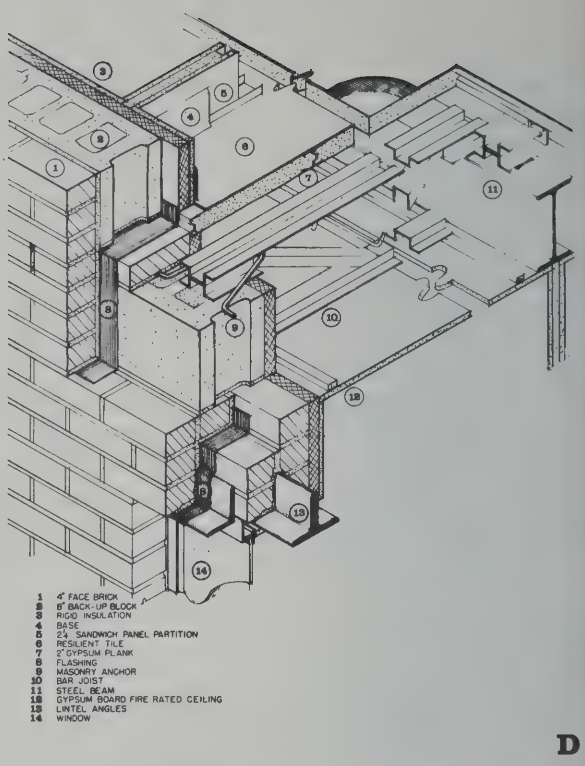

Figure 4. Scheme "D."

parts clipped, snapped, screwed or bolted in a rapid, clean manner.

The five other systems are much more conventional, though several provide considerably greater speed of erection than is possible with the poured-in-place concrete design of Scheme "A." Several of the solutions were chosen because it was felt that they would provide speed and efficiency greater than that possible with the concrete frame. The objective here was to determine whether the aproach which offered speed would also provide savings, since it has not always been the case that the two are "constant companions."

All of the systems except the last required substantial masonry work, particularly in the bearing wall construction where the speed of erection would be very much governed by the time it takes to build each floor of the exterior wall. The sixth system was developed partially to achieve the benefits of time and cleanliness possible with a totally dry system of construction.

The study included a review of the various mechanical systems which appeared applicable to residential structure of the Baychester type. Though no extensive work was done in this area, the examination of these existing systems made it clear that efficient mechanical solutions could be economically integrated into each of the designs.

After the selection and development of alternate approaches were completed, comparative cost estimates were prepared. The costs of the various systems were quite surprising in their variation, but it was notable that the cost of the first system, Scheme "A," the standard residential concrete frame, was more than that of all the other approaches studied. The costs of the cavity wall systems, both bar joist and concrete plank, were substantially below Scheme "A." The fourth system, Scheme "D," using bar joists, gypsum plank and load bearing masonry wall, was also less in cost that that of Scheme "A." The fifth and sixth approaches, however, were by far the most economical. The prices ranged from $10.50 per sq ft for the general construction for Scheme "A" (the highest cost), to $8.18 per sq ft for Scheme "F," (the lowest cost). Schemes "D" and "E," using masonry bearing wall construction, cost less than Scheme "B" and "C," which used cavity wall systems supported on a steel frame. The cost differential was the result of the additional cost of the steel frame over the load bearing wall. It should be noted at this point that the concrete plank systems provided savings by reduced cubage. This approach also reduced the costs by minimizing the quantity of steel used in the framing of the building without compensating penalties. However, it is in the last Scheme, Scheme "F," that the combination of factors produces the most interesting results. Where steel costs raised the estimates for two of the previous Schemes, the use of steel, the manner in which it is used, and economics inherent in the various components selected, provide for savings not possible in any of the previous approaches.

It is felt that this research and the economic studies conducted as part of it have shown that substantial

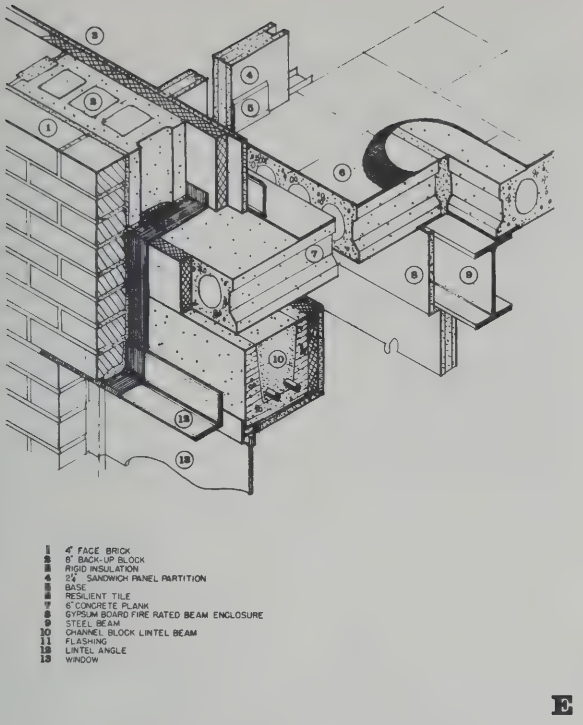

Figure 5. Scheme "E."

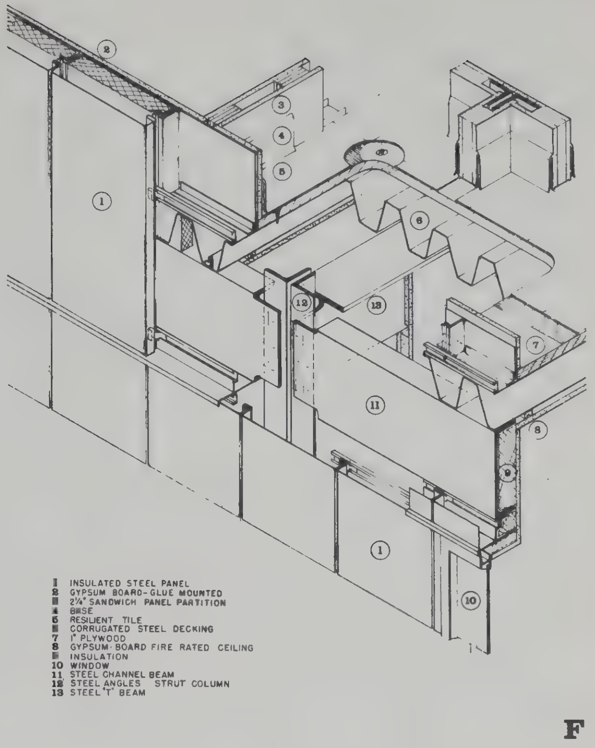
1 INSULATED STEEL PANEL
2 GYPSUM BOARD-GLUE MOUNTED
3 2¼" SANDWICH PANEL PARTITION
4 BASE
5 RESILIENT TILE
6 CORRUGATED STEEL DECKING
7 1" PLYWOOD
8 GYPSUM BOARD FIRE RATED CEILING
9 INSULATION
10 WINDOW
11 STEEL CHANNEL BEAM
12 STEEL ANGLES STRUT COLUMN
13 STEEL 'T' BEAM
F

Figure 6. Scheme "F."

savings can be achieved through the use of steel systems. Scheme "F" and Scheme "B" are considered to offer the most promising alternatives to concrete. Besides being economically feasible in that they offer savings beyond those of a concrete frame building, the fact that they provide a relatively rapid system of construction at a lower cost makes them a most attractive alternative. Scheme "F" has the additional advantage of being a dry, industrial type system that provides a great deal of variety in fenestration design and flexibility in planning.

There can be no doubt that broad applications are possible for these two systems. Manufacturers presently produce all the component parts. Particularly in the case of Scheme "F," it would be possible to develop the technology permitted by steel using familiar component parts modified and adapted specifically to residential applications with little difficulty and at a small cost.

Fire Ratings

The research also included a comparison of fire ratings. The fire ratings permitted by all the systems satisfy most codes and in some instances are in excess of the minimum requirements. In addition we noted that, because of the characteristic modularity of Scheme "F" and the small easily handled components, it is possible to develop both high rise and one and two family residential designs which would utilize aspects of this approach.

While it is true that Scheme "F" has proven to be the most significant innovation, it should also be noted that all the schemes developed provided savings over a system using a concrete poured-in-place structural frame. It appears that the reason for its current survival lies largely in the fact that the technology of construction is familiar with this approach and therefore it favors this technique over the newer and apparently untested and untried approaches delineated here. These systems are by no means new. For example, Scheme "F" is organized in a slightly different manner and applied to a slightly different market than usual, but it represents an assembly of existing component parts that are presently manufactured or are capable of being manufactured from present articles with minor modifications.

It would be possible, in fact, to construct a building utilizing light steel members, corrugated metal decking, plywood planking, and sheetrock partitions as in Scheme "F" in lieu of the current masonry and concrete approach without any serious fear that the system would present any unique problems or hidden costs. This fact also applies to the alternate systems which were developed and studied. It is felt that, while concrete has established itself as the basic structural material in the residential market, it can be questioned, and this research report has indicated that there are perhaps better structural approaches to medium-rise residential buildings than cast-in-place concrete. ☐

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Utilizing Prestressed, Precast Systems

THE FEDERAL HOUSING ACT of 1949 states as its aim: "A decent home and a suitable living environment for every American . . ." Surveying our cities today, almost 20 years later, it becomes obvious that we are far from this goal and, in fact, the need for decent housing is greater today than it was in 1949.

However, in the meantime, numerous redevelopment authorities have come into existence, defining more specifically the number of dwellings required and related problems, and it now becomes clear that the Housing Act of 1949 poses a gigantic problem for which architects, engineers, and the building industry in its present way of thinking, methods, and capacity are not ready.

Intricate problems arise with the development and redevelopment of urban complexes in terms of city planning, performance of building materials, maintenance, flexibility, fire safety, rent levels, and the like, to which economically feasible answers must be found.

Considering the problems in terms of required funds and workload, about one-third of them are directly related to the structure of buildings and items incidental to it. Our firm consists of structural consultants and specialists in prefabrication and it has, therefore, developed a highly industrialized, precast concrete structural system that gives the architect great liberty and flexibility in planning and design. Too, prefabrication within the plant assures tight quality control and makes production independent from climate and weather. Erection procedures are geared toward unskilled labor, and speed of construction can be controlled almost at will. In addition, the same system can be used for low-rise and high-rise buildings, and the same level of efficiency and economy can be maintained in each case.

SEPP FIRNKAS, President, Sepp Firnkas Engineering, Inc., Boston, Massachusetts.

Development of a Precast System

The temptation was great to adopt one or several existing, proven systems as a basis, combine their advantages, and thus create a "new" system. We soon recognized, however, that accompanying the advantages of a system are a number of undesired features and that, by combining two systems, the problems increase in geometric proportions. We therefore started at the beginning, developing problem charts and, by way of elimination, concentrated on materials first, construction methods second, and erection details third.

Wood frame and steel construction were eliminated first, but masonry bearing wall and concrete construction remained. A precast concrete bearing wall and an extruded, prestressed hollow floor plank emerged at the end as survivors. Once the system was decided upon, a thorough survey of prefabrication, transportation, erection, and finishing was made, always keeping the problems in mind. The result was an embarrassingly simple system.

The System

A modular precast building component system with the following characteristics was developed.

Precast, story-high bearing walls with door openings in the transverse direction of the building, leaving front and back walls free to accommodate, in curtain wall fashion, windows, doors, glass walls giving access to balconies, and architecturally desirable wall surfaces. These walls can be cantilevered without penalty, which allows great freedom in layout.

Extruded, prestressed hollow-core floor and roof planks, machine produced in length up to 700 ft and cut to the desired length. Span and depth of the planks was to be a function of the architectural layout and the ratio of cost of bearing wall and plank. Keeping in mind the minimum room size requirements as set forth by the Federal Housing Authority, a module of 16 ft in the longitudinal direction or a multiple thereof was architecturally most desirable but, since the square footage of wall is about 2½ times the sq ft cost of the floor planks, and the cost increase of floor planks within reasonable increase of span is practically negligible, a 32 ft span was selected. The optimum plank depth for the floor live load of 40 psf was then 8 in.

Stairs which, if not used to provide lateral stability to the structure, can be of a variety of materials: steel pans or precast concrete, and they are supported by the bearing walls.

Stability of structure which is provided by semi-rigid connections through the vertical post-tensioning of floors and walls for low-rise buildings, plus additional precast shear walls within stair and elevator tower for high-rise buildings. For tower structures, the layout lends itself to a self-bracing arrangement of the bearing walls. In general, the stability of every structure is checked by a computerized, three-dimensional "box shell" analysis.

Provision for seismic loads which are transferred through the floor diaphragms to shear wall elements and vertical walls, and absorbed by high-strength post-tensioning tendons. The ductility of the complete structure exceeds that of a comparable steel frame structure, without causing cracking of the concrete walls or exceeding the yield strength of the post-tensioning steel. Whatever condition is controlling, general stability or earthquake resistance, determines the number and size of the post-tensioning tendons.

Fire rating, as required by local building codes, which is automatically obtained at no extra cost and which is a function of concrete coverage similar to that of a comparable cast-in-place concrete structure. Underwriters Laboratories labels are available for all of the precast units.

Sound insulation which is excellent, since each apartment is enclosed by 8 in. thick concrete walls and hollow-core slabs of 8 in. thickness, with a mastic levelling course and flooring. Even the most severe standards are met without additional cost. In projects built and occupied, the only noticeable sound transmission occurs through doors into the stair towers.

Foundations which influence the system although site conditions do not. The story-high bearing walls are at the same time deep girders spanning full length from support point to support point, and originating from piles, caissons, or spread footings. The conventional grade beam can be eliminated. Thus it is possible to select the most economical foundation system for any site. Irregular or sloping sites are accommodated by the system without introducing new elements.

Erection and connections by conventional methods. First a wall panel, then a shear wall or stair tower unit and the adjacent wall panel are erected, forming a rigid, stable nucleus from which further erection continues. Three-inch diameter conduits are placed in the wall panels to accommodate the post-tensioning rods for the connection of wall panels to floor units. The rods are anchored into the foundations, are connected at floor level by couplers, extend one floor in height, and serve as rough alignment for the placement of the wall panel by threading the panel over the rods. The lateral final adjustment, which is marked on the floor or panel below, can be done by hand during the lowering of the panel. Once the panel is lowered the crane can unhook while the panel is plumbed with a temporary building jack. Then the floor units are placed and grouted and post-tensioning is done, thus stabilizing one floor, and thereafter the erection cycle can continue. All conduits and joints are grouted with an expansive cement grout mixture containing an additive that was specifically developed and tested to guarantee no shrinkage and a minimum strength of 4,000 psi.

The crane size depends on the height and accessability of the structure. A five man crew (depending on local unions) and separate crew (two to three men) for post-tensioning and grouting, plus a superintendent and a helper for supervision, planning, and establishing levels or a total of from 9 to 10 men, can erect about 4,000 sq ft of building area (including walls, shear walls and floors) if reasonably well organized. The training of the erection crew, which can consist of unskilled labor, can be achieved by a superintendent with experience within three days, since only one type of connection has to be made.

Tolerances for casting and erection are the criteria for the success of a precast system. After thorough study of the limitations of conventional precasting plants and methods, the conclusion was reached that 3 in. tolerance (1½ in. plus or minus) for all connection details of walls to floors and ¾ in. to 1 in. for differential camber of the floor units must be accommodated, while for the dimensional tolerances of walls and floor units the same criteria can apply as for regular cast-in-place concrete construction.

Differential camber is eliminated through a central shore lining up the underside of all planks before grouting. The reliable strength and expansive characteristics of the grout assure a permanent elimination of the differential camber.

Time-Method Study

Beginning with the first project, a time-method study of the erection was made, having as its goal to pinpoint basic errors in design concept, fabrication, and erection procedures. One timekeeper and one photographer equipped with a time lapse movie camera recorded, down to the second, each movement made by each member of the crew, as well as of the crane and trucks delivering the units. The results were amazing.

For example, 20 percent of the total time was expended in wasted operations such as unnecessary switching of slings, unloading of slabs on the ground at the wrong place, hunting for the right tools, just standing around, and two percent of the total time was consumed by coffee breaks. Seventeen percent of the total time went into crane moving, moving of equipment, required changing of equipment, and tools.

Efficiency was thus reduced to 61 percent. After the first preliminary study, it was possible to increase efficiency to 80 percent, even without any basic changes in the system as a whole.

The time study plus the time lapse movie—one picture every three seconds—allowed us, then, to approach the third project, a high rise apartment house, with valuable experience gained.

It was possible to simplify the design and increase the efficiency of the system to about 90 percent. (Coffee breaks and some human idiosyncrasies will probably always remain.) In addition, the overall time requirements for erection were reduced to one-third. Where it previously had taken 51 minutes, 30 seconds on the average for a typical wall panel to be placed and connected in the first project, it took only 16 minutes average time for the latter project for the same operation.

On the fourth and fifth projects similar studies were made in the fabrication plant.

Progress and Future Developments

From the designer's point of view, the system as presented is part of a continuous process. Each project adds to knowledge and this knowledge is incorporated into the following one. For example, our first time-method study showed clearly that the dowel connections then used required too close casting tolerances to be efficient. Furthermore, the erection crew was dependent on the grouting crew, which caused delay sometimes originated by temperatures which were too high or too low. Therefore, the dowel connection was abandoned in the third project and replaced by the post-tensioned connection, eliminating the tolerance problems and providing numerous fringe benefits in terms of erection and stability. Evaluation of the latest study of fabrication led to the conclusion that the casting process of the wall panels should be drastically revised to further increase the efficiency of the system.

The desirable goal is a building system using industrialized components compatible with twentieth century production methods and technological advances to allow better housing at lower cost.

Economy and Predictability

The ultimate measure of success of the system is the overall economy. To prove the competitiveness of the system, the first project was actually designed and cost-estimates were made by the general contractor in steel frame construction, concrete block, masonry bearing walls, precast-prestressed floor planks, and the Tech-Crete System described in this paper. While here the Tech-Crete System costs were only slightly below the masonry solution, savings of about 18 percent were realized on the third project (an 8 story building) over steel framing. After the completion of the latest project a cost pattern seems to emerge.

Unit costs for the completed superstructure per sq ft of structural floor area, assuming a slab on grade for the first floor, ranged consistently between $2.74 and $3.00. No difference was noticed for low rise or high rise up to 9 stories. A slight increase in erection cost is anticipated for buildings of more than 12 stories, since the crane will have to be heavier.

The Tech-Crete System is competitive with conventional low budget construction methods for two and three story buildings if fire ratings must be obtained and if soil conditions are poor, and it is unsurpassed for buildings of four stories and higher. Only a small increase in cost—for erection—allows high rise buildings to be built with the same basic components and the same construction details. ☐

Mr. Firnkas is a member of the American Concrete Institute, the Prestressed Concrete Institute, the Boston Society of Civil Engineers, and the International Association for Shell Structures. He received his Dipl. Ing. from the Technical University, Munich, Germany.

The Bison System for the Construction of Multi-Family Housing

THE BISON WALL FRAME SYSTEM was designed in Great Britain and is operated by Concrete Limited, a long-established firm of specialists in structural precast concrete. The firm started with the production of precast Bison floors in 1919 and has expanded continuously. Today its nine factories produce well over one million tons of structural components annually. These are used in nearly all types of building.

The Wall Frame System is based upon factory-built, precast concrete panels for walls and floors. These panels are assembled by means of suitable cranes, and a very small number of men, into virtually completed buildings. A single gang with a suitable crane can erect from six to ten dwellings a week. The installation of services and finishing follows closely behind and can be finished within six weeks of the roof being waterproofed.

The system consists of two parts. The first is the High Wall Frame System suitable for multi-story point or slab blocks normally from 10 to 24 stories high. In this system virtually all partitions are load bearing and contribute to structural stability.

The second is for dwellings of low or medium heights. This is ideal for "horizontal" multi-family housing with densities of up to 40 dwellings per acre. This was the second part of the system to be developed when it became apparent that the flexibility needed for this type of dwelling could only be provided by using large structural shells with non-load bearing partitions within them. Figures 1 through 3 illustrate the principle of the systems.

There are important differences between the two systems. The Low and Medium Rise System is based on complete flexibility within a 3 ft by 1 ft planning module, whereas the High Wall Frame System is based upon the assembly of standard panels in many different ways with a small percentage of specials to meet unusual requirements. Too, the Low Rise System uses long span prestressed floors in place of short spans in normal reinforced concrete.

At present, the two systems are complementary and work is proceeding on their complete integration. It is this integrated system which would always be recommended to any other company starting to operate in this field.

KENNETH WOOD, Chairman and Managing Director, Concrete Limited, London, England.

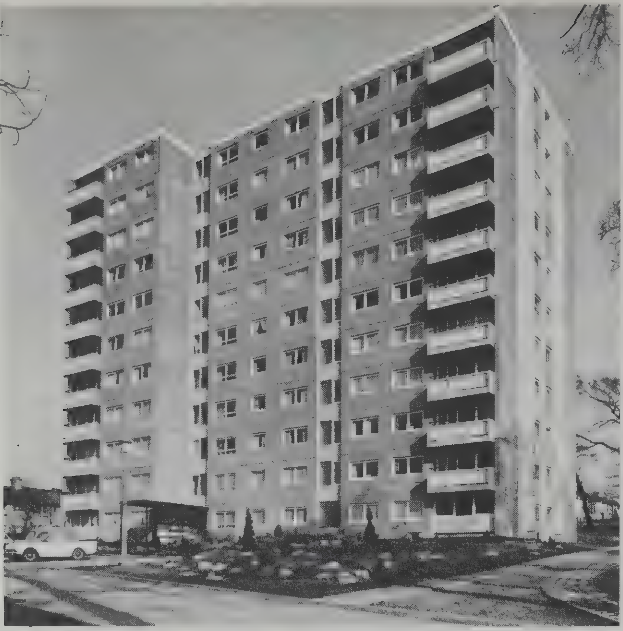

Figure 1. Multi-story apartments at Sudbury Heights, Wembley, demonstrate use of the Bison High Wall Frame System.

Basic Requirements of a System

The Bison Wall Frame System was designed following a review of the social requirements for multi-family housing in Great Britain, and of the building regulations, fire regulations and climatic conditions which might be expected to affect the design of dwellings or the system.

Requirements for multi-family housing differ in every major country and there may in fact be different requirements in different parts of a single country. This is so important that it may be worth referring at a little more length to the particular problems which were considered in Great Britain and which lead to many special features of the system.

The first requirements are social. Many families have been displaced by slum clearance from close communities where a high degree of social contact among neighbors is normal. Such families may not be happy in multi-story dwellings, and horizontal high density developments are sometimes more suitable. Further, high buildings are not thought suitable for large families, so that high buildings in England, although not in Scotland, have been almost entirely for families with children under 15 years of age.

A second point has been the high rate of car ownership among families in the public sector housing in Great Britain. This has meant that accommodation for the motor car and segregation of pedestrians from motor traffic have been important factors in the design not only of the housing estate itself but of any building system.

Another important problem has been the extremely onerous requirements of fire officers in Great Britain which, for various reasons, make it necessary to use different types of dwelling plans from those used in Continental Europe. Finally, the weather conditions, particularly in Scotland and on the West Coast of England, have called for techniques in weatherproofing in advance of those generally found necessary in other countries.

The value of this fundamental planning is illustrated by the record of the Wall Frame System in Great Britain. The first contract was obtained in March 1963. By July 1967, over 10,000 dwellings had been completed in the system and a further 20,000 were either under construction, on order, or under active negotiation. At that time, over 150 dwellings a week were being built.

The Component Approach

In Continental Europe, systems have been designed on the basis of receiving very large contracts. For each of these contracts, plan forms and components of reinforced concrete have been specially designed. This is not the right approach to be used in Great Britain because of the shortage of large building sites suitable for very large contracts. The Wall Frame System has been based upon the use of a large range of standard components into each of which is built a simple varia-

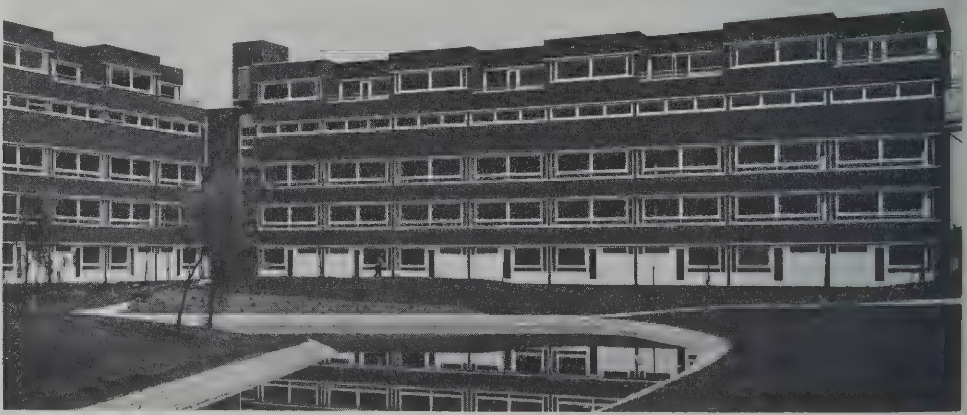

Figure 2. These apartments at Hayesford Park, Bromley, Kent, show the type of horizontal development possible with the Bison system.

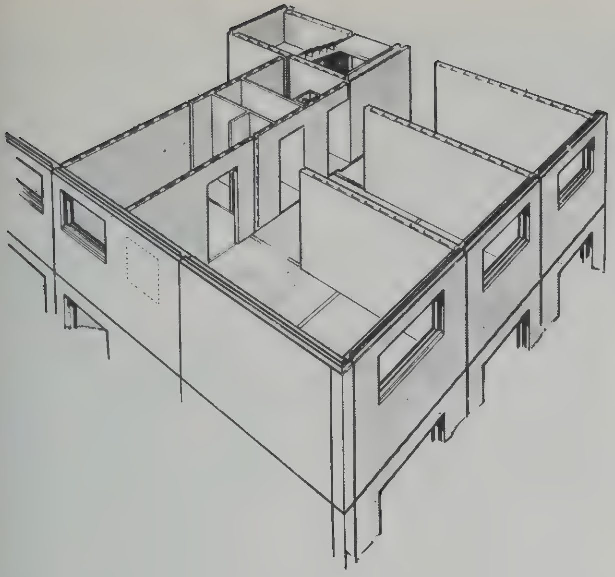

Figure 3. Diagram of the Bison High Wall Frame System with front walls of panel construction.

tion of a single dimension. Thus, floor slabs are of standard widths but the lengths vary in 1 ft modules. Using these standard components it is possible to produce a large range of different plans both for blocks and for individual dwellings.

The plan of a High Wall Frame block is based upon a series of standard wings each of which consists of two flats and of standard links. The manner of assembly is illustrated in Figure 4. This is only one of a large number of varied block layouts. Although this layout is rectangular, blocks with staggered plans are equally possible.

A large degree of variation is permissible in the standard wing and the standard link flats. Similar variations are possible in the link flats.

Even greater variation is possible in the system used for low and medium rise dwellings. Here the size of the individual cell is normally very large and may comprise an entire dwelling. Within this cell, partitions may be of any suitable lightweight material such as studding and plasterboard. The cell itself can be of virtually any size based on a 3 ft by 1 ft planning grid. While the load bearing cross walls must repeat up the full height of a block, the individual partitions and the facade panels can be varied from one floor to the next if this is desired. The arrangement of the planning grid and flexibility on different floors is illustrated in Figure 5. The floor span in Great Britain is limited to 21 ft or 25 ft depending upon the circumstances. There is no reason why these two should not be extended if it is necessary.

As the components are virtually standard except that their length is variable,, they can be produced from standard molds in which only one part of the form is assembled in a variable position. This means that good quality steel molds can be used virtually permanently and are in no way restricted for use to a single block.

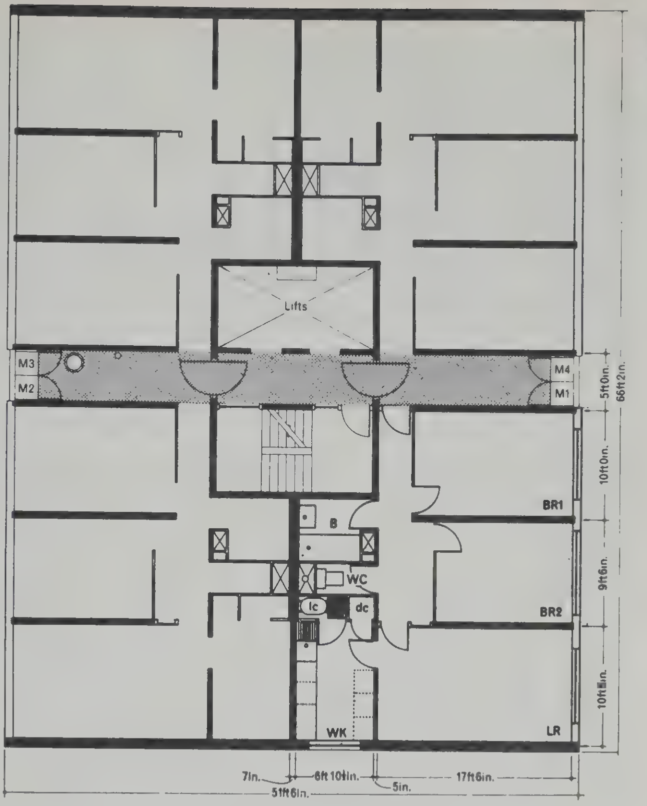

Figure 4. Layout for four two-bedroom apartments on a typical floor of a building constructed using the High Wall Frame System.

Thus, while the initial mold cost is high, the charge to individual contracts is low.

If a system is to offer flexibility it is important that designing, pricing and contract organization shall be so standardized as to make it economical to produce building schemes of moderate size. It is quite possible under this system to erect a single block of perhaps 40 dwellings profitably and with economy in the use of plant and administration.

Avoidance of Architectural Monotony

A great objection to the use of systems has been the fear of architectural monotony. The Wall Frame System has been designed to permit a maximum amount of variation in appearance in order to overcome this criticism.

The first important variation is that blocks designed in the system may have a form which is square, rectangular, staggered or consisting of several linked rectangles. This is illustrated in Figure 6.

The next important variation is in the type of unit which is used to form the facade. These are not load bearing so that they can be either the normal pierced wall, or spandrel panels with continuous fenestration between them. In addition, on contracts of reasonable size, it has been possible to modify slightly the molds to give a heavy molding to the concrete on the outside of the dwelling. Figure 7 illustrates the effect which can be achieved.

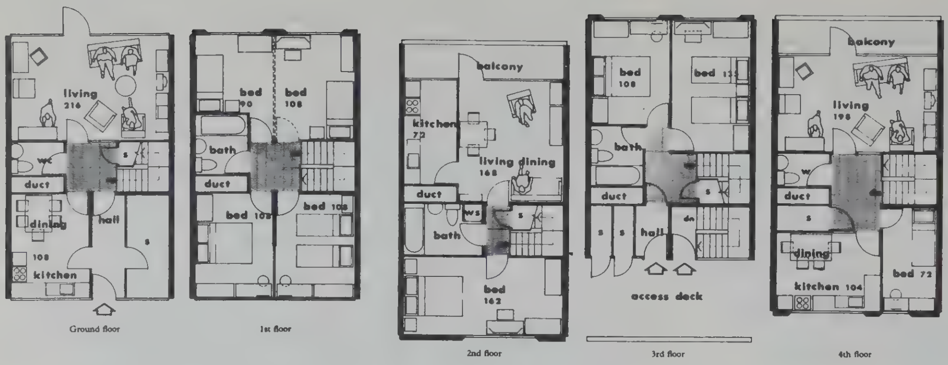

Figure 5. Plan for a five story building with deck access at third floor level to maisonettes at fourth floor and apartments at second floor. There is direct access to maisonettes occupying ground and first floors.

The final variation is in the surface finish of the concrete walls themselves. Here a great variety of colors and textures is offered. Mosaic tiles or other ceramics can be used where a smooth and comparatively expensive surface is required. Exposed aggregate concrete using gravel or granites of various colors and sizes can offer different textures depending upon the method of exposure used. The concrete surface itself may be patterned and, as a final variation, the patterned surface may have the face split off offering a coarse and well textured colored finish.

The Engineering Design

The fundamental principle on which the engineering design is based is that large, precast concrete panels are joined together by in situ concrete stitches in such a way as to produce an effectively monolithic structure. Obviously, there will be some degree of structural weakness at the joint. In European countries where neither earthquakes nor hurricanes are encountered, this produces no important problems in dwellings up to about 30 stories. Where, however, wind loadings in excess of 35 lbs per sq ft are encountered, it may be necessary to increase the amount of reinforcing steel used to link components for dwellings of 16 stories and more.

The basic principle of the construction is that cross walls and gable walls are load bearing and that the structure is stiffened in the other direction by internal structural walls. In general, the vertical units are joined together merely by means of castellations on all four sides providing shear keys through in situ concrete stitches. In some cases, especially at corners, reinforcing steel protrudes through the sides of the units and makes a more positive link between adjacent components.

The floor units are designed as simply supported precast units using either traditional or prestressed reinforcement. These are connected to one another and to the walls by means of protruding reinforcing loops

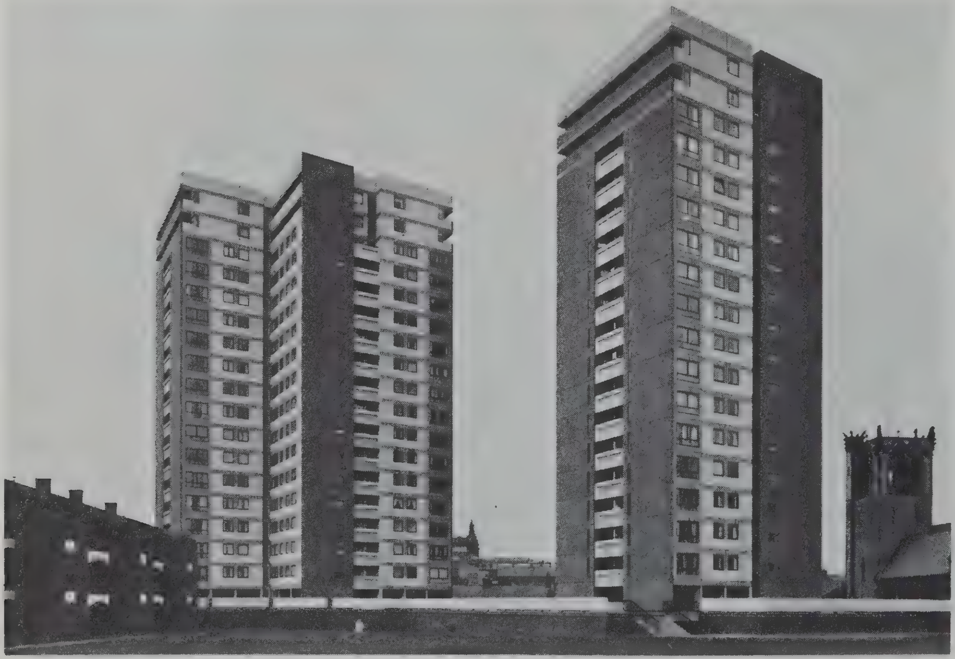

Figure 6. Buildings designed using the Bison system may vary in form. These apartments are at Avenham Lane, Preston.

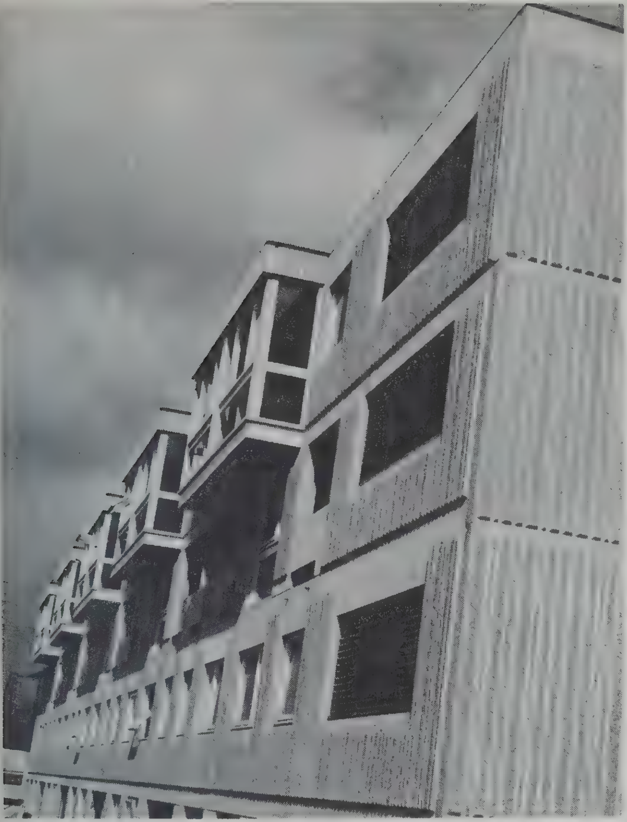

Figure 7. Modification of molds permits avoidance of architectural monotony in exterior treatment.

placed over dowels cast into the tops of the wall units. In some places, however, it is necessary to use site bars or welded ties to join one component to another.

It is normal to incorporate some form of impact noise resistance into the floor components themselves. This is done by means of a sandwich floor with a structural element at the bottom and a floated off concrete screed at the top, the two layers being separated by a soft material such as precompressed polystyrene sheet. The sides of the screed are similarly insulated from the structural walls. In the High Wall Frame System where short spans are used, the structural floor is of reinforced concrete 5½ in. thick and the overall floor is 8½ in. deep. In the case of Low and Medium Rise Systems the floors are prestressed and the structural floor usually occupies 7 in. from a total depth of 9½ in. This is satisfactory for spans up to 21 ft, but for longer spans a soft floor covering is used and the whole 9½ in. is occupied by the structural floor.

The external wall units are also sandwich units with a structural layer of concrete on the inner face. This is 6 in. thick if load bearing and 4 in. thick if merely used as cladding. The outer decorative face is 3 in. thick and the two are separated by a continuous layer of precompressed polystyrene. The two faces are tied together by suitably designed phosphor bronze hangers.

Apart from the elimination of cold leaks and the consequent risk of condensation, the 100 percent insulated sandwich restricts the thermal movement to the outer face. These outer faces are completely separated from one another. The structural concrete where the components are joined together remain at a virtually constant temperature. This has a most important effect in the reduction of cracking in the finished building.

Weatherproofing

The jointing against water penertation provides special problems on the West Coast of England and Scotland where long periods of virtually continuous rain frequently occur. It is considered in Great Britain that the open drain joint as used in Scandinavia is more satisfactory than one dependent upon an external use of mastics, but in fact this joint is not adequate under certain weather conditions. It is necessary in the worst British climate to either greatly increase the depth of the joint and the size of the horizontal overlap, or to provide a second line of defense. On the whole, the second line of defense would seem to provide a more satisfactory answer, and this method has been used with complete success.

Despite the attention which is paid to waterproofing between joints of concrete panels, there has never been any great difficulty at this location. The principle cases of water penetration in precast concrete structures have arisen mainly between panels and windows at individual balconies, and through the asphalting on the roof where many special problems may be encountered. Most of these have to do with parapet walls, ventilation outlets, soil pipes, and various roof top structures. In common with all systems used in Great Britain, some degree of water penetration occurred on the earlier blocks but, after redesign, particularly of window and balcony detail, no further trouble has been experienced even during the abnormally wet and windy winter of 1966-1967.

Finishes and Service

The internal faces of concrete walls are finished ready to receive either wallpaper or textured paint direct. Where emulsion paint is to be applied to the concrete, it is necessary to fill blow holes with plaster using a technique very similar to that used for the finish for dry linings. The ceiling is finished without visual joints and the same finishing techniques are employed as for the walls. As already explained, the floor has built in impact noise resistance, and a hard floor covering such as vinyl or thermoplastic tiles may be applied direct.

Provision for electrical services is made within the structure. Basic wiring is normally carried out during erection with lengths of electrical cable contained in polyvinyl chloride tubing. Easily accessible hand holes are available at bends and junctions. Switch boxes and powerpoint boxes are cast into concrete walls. The system is fully rewireable.

The design of central heating and of water and gas distribution is extremely simple. The plan of the dwelling makes it possible to reduce horizontal service runs to a minimum. In most cases they are covered by wall furniture but, in a few cases, pass within the in situ concrete joint between floor slabs. The installation of these services is quick and simple.

The materials other than concrete components are normally palletized and put on the floor of the dwellings by means of the normal erecting crane. The palletization is sometimes done away from the site, but on large contracts it is normally organized from a site store.

Slots are cast into the concrete to simplify the installation of elevator doors and rails. The elevator cage and hoisting equipment are lifted into position with the site crane.

Costs and Labor

The rapid progress in systems building is due partly to the acceptability of the system and partly to the low level of prices and costs. This has made it possible for the system to obtain nearly 15 percent of the total British market for multi-family dwellings within four years of its introduction.

The use of labor on sites varies considerably, dependent both upon the detailed design of the structure and upon the degree of repetition on a particular site. In the Low and Medium Rise System there is rather less precast concrete and rather more joinery than in the High Wall Frame, and the degree of prefabrication in the latter material will also affect the time taken on the site. In general terms, the erection of the concrete components will take between one and one and a half man weeks per four person dwelling. The bulk of the site time is taken by the labor dealing with finishes and services. Including all trades, this will vary from as little as six man weeks to as much as twelve. Part of this variation is due to the performance of different contractors operating on this subcontract work.

The time utilization in the concrete factory again depends to a considerable extent on the types of contracts and on the proportion of precast concrete in the total dwellings. In High Wall Frame construction, where more precast concrete is used, the total labor consumption per dwelling is about five man weeks. Of this, less than half is spent on actual production of components and the balance is spent on factory administration, storage, loading, maintenance of plant, and the like. The labor employed on direct production is somewhat higher than in some systems, and this is one of the penalties of the degree of built-in flexibility. In general terms, however, the total cost of direct production labor represents only a little over two percent of the final contract price.

Administration of Design and Construction

The administration of design and the erection of the Bison System differ from most other systems in the world. Concrete Limited is a firm which specializes in precast concrete with factories throughout Great Britain. It does not normally undertake any work other than the design, manufacture and erection of its own concrete components so that the site works, the services, and the finishes are normally organized by a separate contractor. It is necessary that there be very close collaboration between the concrete specialists and the other contractors. To make this possible, it is normal for the relationships to continue over reasonably long periods and not merely for the term of a single contract. By working with a number of different contractors the local influence of the concrete contractor is extended and his sales force is strengthened. There can be possible failure of cooperation, but this is not necessary provided the concrete specialist is clearly the leader and understands exactly what form of cooperation is needed.

In the same way Concrete Limited does not employ its own staff architects but it has used over 40 different firms of private architects as well as local authorities' own architects to design the schemes. A number of architects have specialized in this field and these are used as consultants in cases in which the architect himself has had no previous experience with this system of building. In most cases the architect is employed and paid by the concrete specialist and this assists in ensuring complete cooperation between the designer and contractor. This has gone a long way toward reducing objections from the architectural profession, and it has also assisted in obtaining a greater variety of architectural treatment than has any other system in the world.

The practical administration of a business engaged in the selling and erection of concrete system housing is fairly complex. The complexity arises mainly from the difficulty encountered in coordinating the operations of architectural designers, engineers, precast concrete specialists, factory production staffs, site erection staffs, and the various contractors engaged on services and finishes, as well as one of the most difficult: the client. It is not the type of administration which lends itself to computerization because, once the facts are established, the detailed working provides no clerical difficulty. The vital point is to provide a regular flow of work for everyone concerned, whether designer, factory worker, or erector, and it is in obtaining this flow of work and in levelling out the peaks and troughs that the skill of management really lies. For this purpose a well trained technical sales staff is a vital need.

Future Development

It must be understood that development of a building system is not a job completed once and for all. Development is a continuous process, and this is as important in building as in any other commodity. The mass production of system built dwellings at high densities soon leads to monotony, and constant development is necessary if only to alter the appearance of the dwellings. For example, large scale work for the City of Birmingham was started in the middle of 1964. Although the basic dwelling plan was left unaltered, the appearance of the dwelling was completely amended by a redesign in 1966, and soon a third type will be employed with again a completely different appearance and, in this case, a different dwelling layout. ☐

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Load-Bearing Masonry Systems

The last load-bearing masonry building of historical significance built during the nineteenth century in the United States was the Monadnock Building in Chicago, constructed in 1892. This structure represented a landmark in the high-rise buildings of that era, just prior to the invention of skeleton-frame construction. The walls of the building, ten stories tall, started with a thickness of 16 in. at the top story, flaring out at the bottom to as much as 6 ft between windows. It is not necessary to say that such masonry proportions were theoretically far less than the strength limitations of the materials themselves. However, at the time the structure was designed, very little was known of the compressive strength of clay masonry.

With the advent of reinforced concrete and steel frame construction, which became popular at the beginning of the twentieth century, skeleton-frame construction swept the field as the usual method of high rise building erection. To this day, skeleton-frame construction is still regarded as the primary means of creating economical high rise structures. This position, however, was challenged in Europe at the end of World War II.

In Switzerland, during the years immediately following the war, through the joint efforts of the clay brick manufacturers and the technical institute, EMPA, a series of tests was performed on the compressive strength of brick masonry prisms and wall columns. This work provided the Swiss engineers in the early 1950's with sufficient information to build a few high-rise buildings to heights of 10 to 16 stories. The earlier structures were built in Basel, Switzerland, with later structures appearing at Lucerne and Zurich.

By 1960, unreinforced load-bearing brick structures had been built to heights of 18 stories, the most outstanding of which is an apartment house in Schwamendingen, a suburb of Zurich. The Schwamendingen Building, being a typical Swiss apartment house, contains many rooms of relatively small dimensions, with spans not exceeding 15 ft. Utilizing all vertical wall elements, including closets and kitchen and bath partitions, all walls within the structure were put to work as load-bearing elements supporting two-way reinforced concrete floor slabs. The maximum thickness of the walls in the Schwamendingen Building was about 16 in.

In Biele, Switzerland, a series of 16 story, cavity wall, load-bearing structures was built in which the exterior walls were constructed using an interior wythe 6 in. thick upon which the floor systems rested. All interior partitions were of thicknesses ranging from 4 to 6 in., with the floor spans again not exceeding approximately 15 ft. The exterior walls of this structure were clad with 4 in. of masonry separated from the 6 in. bearing wythe by a 2 in. air space filled with insulation. Essentially, these structures were carried to 16 stories on approximately 6 in. of masonry. These structures were unreinforced vertically.

Following this immediate effort in the post-war era in Switzerland, the concept spread to Denmark, Holland and England, where load-bearing buildings of substantial height were built in the cities of Copenhagen, Amsterdam, and Manchester.

Interest in the United States

Since 1960 there has been a revival of interest in load-bearing masonry in the United States. Influenced by the work in Europe and the inherent advantages of the system in the American economy, this form of construction has become attractive because it offers several economic and design advantages. In a sense, carrying a structure on one-dimensioned long prismatic beams (which in turn rest on relatively long slender columns) results in unnecessary stress concentrations at the juncture of these building elements. This is particularly true if the structure contains a large number of repetitive fixed partitions which is certainly the case in many types of urban multi-family structures. The use of walls, both as load-bearing elements and as shear walls to withstand lateral forces (including earthquakes) proves to be relatively economical.

When the main resisting elements are two-dimensional planes rather than one-dimensional prismatic members, the stress distribution within the structure is relatively low-level when compared to the high-stress concentrations in ordinary skeleton-frame constructions. Using the floors in diaphragm action in a two-dimensional way, similar to the walls, results in a marriage of floor and wall systems that proves to have decided structural advantages. Even in the structural analysis of the system itself, there is considerable savings over the conventional techniques of analyzing skeleton frame construction that is continuous.

While, with the advent of modern computers, sophisticated analysis can be carried forward with a considerable degree of speed, nevertheless the inherent simplicity of load-bearing structures, which become simply short

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plates in bearing and simple cantilever beams in transverse resistance, has an analytical appeal of great simplicity to the designer. European design offices claim a 15 percent or more saving in actual man-hours spent in design, detailing and analysis.

Foundation arrangements are extremely benefited by a load-bearing building because the loads delivered into the foundation are line-loads as opposed to point concentrations. Finally, it may be pointed out that the use of load-bearing construction is not too different in actual construction from many skeleton-frame constructions wherein the walls themselves actually utilize the same masonry materials as infilling between the beams and columns.

In short, such heavy, dense wall materials which have been incorporated largely because of either their fire resistance or their acoustical resistance can be put to work structurally, thus eliminating substantial portions of the skeleton frame. It was this fact, in itself, which has resulted in substantial economies wherein the concept has been applied to its fullest.

Benefits of Load-Bearing Construction

In addition to structural resistance benefits, load-bearing masonry construction offers considerable amounts of fire resistance and acoustical resistance. Very frequently, the very same materials that are used to obtain fireproofness in skeleton frame construction are those materials that can be used as structural elements in load-bearing masonry. Needless to say, one of the chief ways to achieve acoustical isolation is to utilize walls having substantial mass which most masonry materials inherently have. While acoustical resistance has not received the attention in this country that it has in many European codes, it appears that there is a continuing interest both by the public and mortgaging institutions in providing buildings in which greater attention is given to acoustical isolation between living units. Apartment occupants frequently testify to the superiority of load-bearing masonry structures in terms of the improved acoustic isolation that is enjoyed.

Architectural Aspects

Finally, the architectural aspects of load-bearing masonry may be mentioned. In the first place, it provides the architect with a new idiom of aesthetic expression which has yet to be fully and imaginatively developed. Modern load-bearing masonry structures should not look like the Monadnock Building or the load-bearing structures of the late Nineteenth Century. With the modern methods of engineering analysis and the improved understanding of the structural resistance of materials, our aesthetic expressions should reveal this improved technology.

In terms of architectural detailing, considerable simplification is achieved in wall lines that are essentially broken by the presence of jutting columns and general variations of wall thicknesses that are normally inherent in conventional skeleton frame construction. It has been found that, in buildings up to 20 stories tall, it is usually more economical to carry the same wall thickness for the full height of the building despite the fact that its upper reaches require less material structurally.

It is probable that in most cases of ordinary spans in multi-family residential construction, load-bearing masonry will not require wall thicknesses in excess of 8 to 12 in. This, of course, is in quite a contrast to the current code requirements that insist in many cases on minimum thickness ranging from 16 in. to 24 in. for buildings of even lower heights than these.

In summary, then, the inherent structural advantages, and the automatic superior fire and acoustical resistance that masonry provides, coupled with the possibilities of new architectural aesthetic expression and simplicity of architectural detailing, have argued well to make a revived interest in load-bearing structures worthwhile economically.

Historical Survey of Experimental Knowledge

Historically, the earliest masonry tested in this country consisted of brick prisms, tested in the 1880's by the Watertown Arsenal in Connecticut. At that time this institution possessed the only testing facility capable of testing prisms of any size in clay masonry. Between 1880 and 1915, a considerable number of prism tests were undertaken by the Arsenal on brick prisms ranging in h/t (slenderness values) from two to ten, having dimensions which, for the most part, were square in cross-section. Very little wall column testing was undertaken during this period.

Following the Watertown Arsenal work, upon the creation of the National Bureau of Standards, testing of clay masonry was undertaken beginning in 1915 and extending through 1930. In the latter part of this period, particularly in 1928, a series of wall column tests was undertaken. The columns tested had dimensions of roughly 4 ft by 9 ft. Throughout this period at both the National Bureau of Standards and the Watertown Arsenal very little eccentric load testing was undertaken.

From 1900 to 1920 there was a considerable amount of prism testing done at several university laboratories including Columbia, Cornell, Purdue and the University of Illinois. This work, coupled with a modest amount of work done in foreign countries such as Canada and Sweden, culminated by 1930 in a comprehensive series of about 1,000 prism tests on clay masonry.

This work was compiled and studied by a building code committee appointed by the Department of Commerce in 1921, with the committee's activities extending through 1928. The primary purpose of this building code committee was to examine critically the then existing codes in the United States to determine if changed regulations for the use of these materials would be economically fruitful.

This committee's efforts, later modified by other committee activity in the early 1930's resulted in recommendations which became the basis of most code regulations in the United States for the design of load-bearing masonry systems. While the original committee's efforts recognized the superior strength characteristics of masonry in compression, the allowable design levels for the use of this material were greatly restricted, not only in terms of stress level permitted, but also in terms of minimum wall thicknesses or maximum slenderness ratios allowed.

This conservative viewpoint in the establishment of masonry regulations stems largely from lack of data on tensile strength resistance both in the form of transverse wall strength and of diagonal tensile resistance in shear walls.

The fear of the unknown behavior of masonry wall systems in tension resulted in the relatively conservative code regulations that were then adopted by many governing authorities throughout the United States. In many cases these regulations, although modified through the American Standards Association in 1944 and 1954, have largely remained in effect even to this day. However, certain code groups have adopted the Structural Clay Products Institute's "Recommended Building Code Requirements for Engineering Brick Masonry," May, 1966.

Current Research Activities

Except for the work done during the 1930's and the 1940's, largely by the Bureau of Standards and published in the Building Materials and Science series, very little formal investigation took place in this country on non-reinforced load-bearing masonry systems during the depression and World War II years. With the beginning of the Structural Clay Products Research Foundation in 1950, work was undertaken in the area of transverse strength of clay masonry walls. Later, similar work was undertaken by the National Concrete Masonry Association and the Portland Cement Association.

During this same period of time, considerable interest has been shown in obtaining experimental data on the shearing resistance of clay and concrete masonry systems (particularly those which are reinforced) by a number of efforts on the west coast. During the early 1960's the Structural Clay Products Research Foundation (SCPRF) undertook a series of investigations of diagonal tensile strength.

Currently, the Dow Chemical Company and SCPRF are sponsoring research fellowships at the National Bureau of Standards devoting attention to the aspects of both tension and shear resistance in clay and concrete masonry wall systems. In Europe, particularly at the University of Edinburgh, considerable work has been done on shear resistance of walls, as well as small scale model studies of masonry wall systems. Bearing, transverse, and shear resistance have been under study at various times in the British Building Research Station at Watford, England.

While this current research work has generated considerable knowledge about the tensile behavior of masonry wall systems, an aspect of bearing strength not heretofore thoroughly investigated in this country has been undertaken by SCPRF in considerable detail. This has to do with wall column action which, in a sense, is also a matter of flexural or tensile strength resistance. While, in the earlier test series prior to 1930 some small, sporadic attempts were made in an effort to determine the influence of slenderness ratio and eccentricity on wall column strength, these efforts were relatively small in scope, and the results were such that no definitive code recommendations could be made.

In the early 1960's, as a part of a national testing program by SCPRF, a relatively vigorous and extensive program of prism and wall column investigation was undertaken. This work provides the designer with relatively precise analytical and strength of materials data so that he can accurately take account of wall slenderness as well as eccentricity in the design of masonry walls.

That so much effort should be placed upon bearing strength is not surprising when it is observed that the prime limiting feature in most load-bearing construction is bearing strength, as opposed to tension in the form of flexure, or tension in the form of diagonal extension. Paradoxically, while masonry is relatively weak in tension, it is a fact that in many cases the bearing or compressive strength controls the design. Actually, even in the case of bearing strength, a limiting feature is still tension, for the prime mode of failure in a clay masonry system is the vertical splitting of the wall rather than a bearing compression failure, as might be expected by the uninitiated.

It is well to describe the mode of failure in masonry, subject to bearing action. When a masonry assemblage withstands a compressive load, both the mortar and the masonry unit will expand laterally as a result of vertical shortening. Generally the modulus of the mortar is far less than that of the masonry unit. As a consequence, the lateral extension of the combined assemblage will result in the generation of tensile stresses in the masonry unit which will cause it to split vertically, or parallel to the application of the load. Certain masonry units which have stiffness approaching that of the mortar may not so behave, but these would fail in the classical, shear type of failure, as experienced in the crushing of mortar cubes. Thus, in all likelihood many failures, under test of masonry systems in compression, will actually be a result of tensile failure. Tensile strength, essentially, can control the behavior of any load-bearing masonry system subjected to any of the three kinds of basic loads: bearing, transverse, or racking.

Design Analysis

Both clay and concrete masonry have recommended design values in compression based generally upon the strength of either the mortar or the unit, or both. Associated with the compressive strength values, which are primarily for short compression prisms, correction factors must be used for the influence of slenderness and eccentricity on wall column design.

While bearing may be the chief concern to most design applications, it is necessary to have design values for transverse strength as well as shear or diagonal tension. Most codes make provision for a difference in transverse strength between spans which are vertical or horizontal, or more particularly for a difference between strength perpendicular or parallel to the bed joint. Not fully recognized, however, is the influence of the bed width on transverse strength. For example, it is well known that fairly wide bed joints in four and eight inch walls of solid masonry have greater strength than similar wall thicknesses made of hollow tile units.

It appears that the strength of relatively thin hollow unit cross sections is affected by the ability of the mortar bed to dry out in both directions rather rapidly, both to the interior of the hollow spaces as well as to the exterior environment. Such rapid cures result in reduced transverse strength.

While this condition may be corrected by appropriate curing of the wall, by wetting, or by other techniques, this is not fully recognized by either designers or practitioners in the art of construction. As to diagonal tension, research is still in progress in this area and the design recommendations made are the best estimates that can be deduced from available data as of the time of the code compilations. In general, for shear walls, the code recommendations are relatively conservative and may be used quite safely. Particularly this is true if the wall, in addition to acting as a shear wall, will also act as a bearing wall, for the presence of normal stresses perpendicular to the bed joint frequently enhances the shear resistance by the inherent friction generated by the bearing action. Behavior of masonry in this kind of application of shear has yet to be fully explored. Current test data suggest that shear in beams may require more conservative recommended working stresses than shear in walls.

Sufficient knowledge is now available for the designer to proportion a structure for bearing transverse and racking loads. Much of this is of commonplace knowledge in most structural offices. However, it is readily admitted that the joint action of floors and roofs, acting as diaphragm planes together, is probably a matter of new experience to most designers who are primarily schooled in skeleton-frame analysis. Nevertheless, the basic procedures of analysis that are inherent in skeleton frames may be applied with direct success to load-bearing masonry wall systems. Such frameless buildings may be regarded as a framework of two-dimensional members as opposed to a space framework of one-dimensional members, as in the case of conventional multi-story skeleton frame construction.

The method of design is usually much more simple and the method of analysis will prove to be less tedious to execute. One of the chief problems of concern that may be mentioned in passing is that of shear walls that are non-load bearing. Such would occur in the case of long, narrow structures in which the longitudinal exterior walls are the load-bearing elements, and the cross walls are merely inserted for racking resistance. This case may result in a critical value of shear or diagonal tension. In general, buildings of less than ten stories, with wall thicknesses of at least 8 in. will probably not prove critical providing the spans between walls are not over 16 to 20 ft.

Of great usefulness to the designer is chapter 4 on Structural Design of Brick Masonry which may be found in SCPI's "Recommended Building Code Requirements for Engineered Brick Masonry." This places clay masonry design on a thorough, rational analysis basis. In general, the allowable stresses and methods of analysis are similar in form to those for reinforced concrete. Ultimate compressive strengths may range from 2,400 psi to 4,600 psi depending on the type of mortar used. Higher values may be used if demonstrated by test.

Allowable stresses in flexural tension and shear for unreinforced masonry will be found useful. Stress reduction factors for column action, as a function of slenderness ratio and degree of eccentricity, are available. Both of these items represent a marked improvement over the earlier masonry codes which attempted to limit design by citing an arbitrary slenderness ratio and minimum wall thicknesses. In short, this code will enable masonry design to proceed on a code performance basis rather than the traditional code specification basis. Criteria for allowable stresses in reinforced brick masonry are also available. These parallel, in many respects, the familiar American Concrete Institute standard 318-63.

Chapter 5 of the brick masonry code also provides a number of important recommendations on construction techniques. Tolerances on the plumbness and levelness of the brickwork are established. This is important in achieving optimum structural capacity. Chases not contemplated in the original design cannot be arbitrarily built without authorization. Limitation on the creation of brittle notches leading to unwanted stress concentrations is important when masonry is used structurally. Suitable protection is prescribed when masonry is built during freezing weather.

To summarize, construction practices that may be tolerated in non-structural masonry are not permitted when the masonry is used structurally. This may require, for important work, continuous field inspection, a practice long used on reinforced masonry in California.

Recent Projects

In recent years, a number of load-bearing masonry structures have been built in this country and in Canada. Conceptually, two schemes of bearing walls are possible: longitudinal and transverse. While a given project can be a combination of the two, generally one approach prevails over the other. The longitudinal approach presents the problem of window openings in the bearing wall, as well as the difficulty of non-loaded shear walls. In the transverse arrangement the walls will act both in shear and in bearing. However, the former arrangement provides for greater partition flexibility. ☐

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Mobile Home Apartments

IN THE PAST FEW YEARS the mobile home industry, while supplying an increasing amount of the nation's housing, has undergone changes that in many ways are reminiscent of the shift from the old days of tourist cabins to today's luxury motels. The most significant change was that of "image" and acceptance as an appropriate commercial and quasi-residential use of land.

The "image" of today's mobile home is also changing, since for years it has been going through a similar metamorphosis in terms of gaining public acceptance.

Compare the mobile home of 30 years ago with a modern, well planned mobile home park development with street lighting, curbs, gutters, and hard surface streets. Except for density, it is no different from any other type of housing subdivision. The rapidity of this change is not yet fully appreciated in many parts of the country, and the same can be said for the potential of the mobile home as a permanent housing unit.

Production of mobile homes in the past 20 years has been increasing at a very substantial rate. In 1947, 60,000 mobile homes, valued at $146 million, were shipped to dealers. In 1966, 217,300 mobile homes homes were shipped to dealers. These homes were worth more than $1,238 million. In 1966, the mobile home made up 27.9 percent of the total single family, non-farm, private housing starts. In 1967 that figure was expected to pass 30 percent. Another impressive figure to consider is that, in 1966, the mobile home industry produced 76 percent of all housing priced under $12,500. Over five million people now live in mobile homes.

These statistics point to a significant fact. The impact of the mobile home in the low cost housing market is already great, and it is growing at a rapid pace.

Homes Serve Different Age Groups

From a marketing standpoint, mobile homes have been serving the fastest growing segment of the population in the United States on the basis of age and income. The under-34 age group accounts for 43 percent of all mobile home sales. Three fourths of all mobile homes are sold to families with incomes of under $7,000. It is estimated that there will be a gain of 11 million persons, or roughly 43 percent in the 20 to 30 age group by 1975.

The marketing firm of Elrick & Lavidge relates these figures to future housing needs by stating, "the annual increase of household formations is expected to grow between 950 thousand and one million for the next several years. To be more precise, during the next 10 year period, the number of young marrieds in our society will surge ahead at a rate of two-and-one-half times faster than the population as a whole. These young people are going to alter the contours of several important markets." One, quite obviously, is housing.

Another great share of the mobile home market, better than 25 percent, is composed of elderly and retired persons. This group is expected to expand by 15 percent by 1975. Inexpensive housing such as that provided by mobile homes appeals to members of this group, because they must live on limited incomes after retirement.

It is estimated that the early 1970's will show an annual production of over 400,000 mobile homes, an amount nearly double the total produced in 1966. From these statistics, three basic facts emerge. There is a growing acceptance of the mobile home as a type of permanent shelter. Factory-produced and transported mobile homes are available at a relatively low cost, and there is a decreasing mobility of the mobile home as it takes on the characteristics of conventional housing.

Rental of a site in a mobile home park is the most common practice today. The modern mobile home park can be likened to a "horizontal" apartment building.

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However, lot ownership and conventional financing are increasing. Particularly promising for this type of program is the development of the sectional or double-width units which utilize the same techniques of factory production and are still well within the badly needed $15,000 market.

Many of these double-width units are indistinguishable from the conventionally built or prefabricated one-story dwelling. The mobile home is factory furnished. The advantages of savings through mass purchasing of appliances and furnishings and "one package" financing to the purchaser in a lower income bracket is obvious.

Recently, the Mobile Homes Manufacturers Association (MHMA) has been called upon to design and develop techniques for other kinds of shelter, keeping in mind the basic module of the mobile home. One new concept in the employment of the mobile home consists of single story, high density use. This use approaches the concept of a mobile home apartment. The design incorporates both front and rear patios. Adequate parking is provided. Each unit can serve as a single apartment, or a combination of two or more units may make up the apartment.

In the spring of 1967, the Office of Science and Technology, Executive Office of the President, in collaboration with the Department of Housing and Urban Development, invited the manufacturing members of the MHMA and appropriate officials of interested departments and agencies of the United States Government to discuss new technologies for fixed site, low cost housing in urban areas.

Two major concerns were discussed. The first was what the industry can accomplish immediately with factory constructed, sectionalized living units to solve the shortage of satisfactory housing faced by low and middle income residents of urban areas. From this immediate goal, MHMA was asked what could be proposed in the next two years and what potentials exist for longer range planning.

The second concern had to do with what changes in governmental policies and programs could improve the environment so as to encourage innovation by the industry.

The difference (and it is sizable) between the cost of a completely furnished mobile home of approximately 1,000 sq ft from $7.50 to $10.00 per sq ft, and the cost of a dwelling constructed unfurnished on site from $14.00 to $17.00 per sq ft is attractive.

High Density Development

It has been asserted that the industry is now in a position to manufacture town houses and garden apartments for projects with densities of 20 or more units per acre. Material preferences and configuration requirements do not pose severe problems. A two-story concept exists which uses either conventional mobile homes on wheels or mobile home modules without wheels. Some mobile home manufacturers are already producing fixed housing as well as school room modules, temporary offices and stores, churches, motels, dormitories, and factory complexes. Emphasis is given to the speed of erection of these factory-made complexes as contrasted with conventional construction. Interested members of the Mobile Homes Manufacturers Association have adapted the mobile home module to town house use. A stacking arrangement has also been developed which can be used to a height of beyond two stories. Low or high rise units using a steel skeleton structure for support have been conceived.

Meeting Low Cost Housing Needs

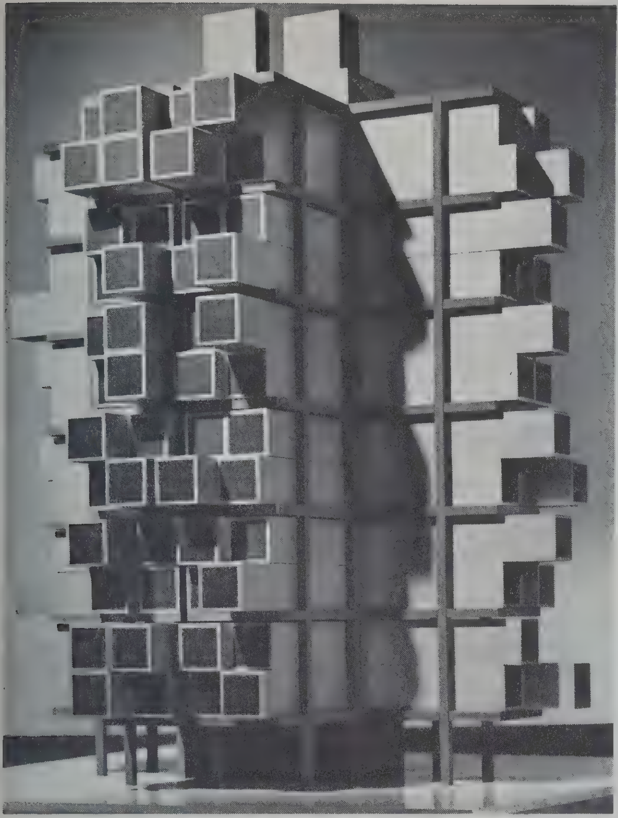
A supplier member of the Mobile Homes Manufacturers Association, Jones and Laughlin Steel Corporation of Pittsburgh, Pennsylvania, felt that the mobile home industry was in an excellent position to meet the need for low cost housing because of its manufacturing facilities, marketing, purchasing, and the technical organizations already available.

Jones and Laughlin commissioned the architectural firm of Dalton-Dalton Associates of Cleveland, Ohio, to develop a series of new design concepts for such housing. The Dalton-Dalton staff which participated in this project included not only architects and designers familiar with housing, but also structural, mechanical and electrical engineers in order to insure a series of designs that would be technically feasible and built to acceptable standards with the assembly line facilities now existing in the mobile home manufacturing industry.

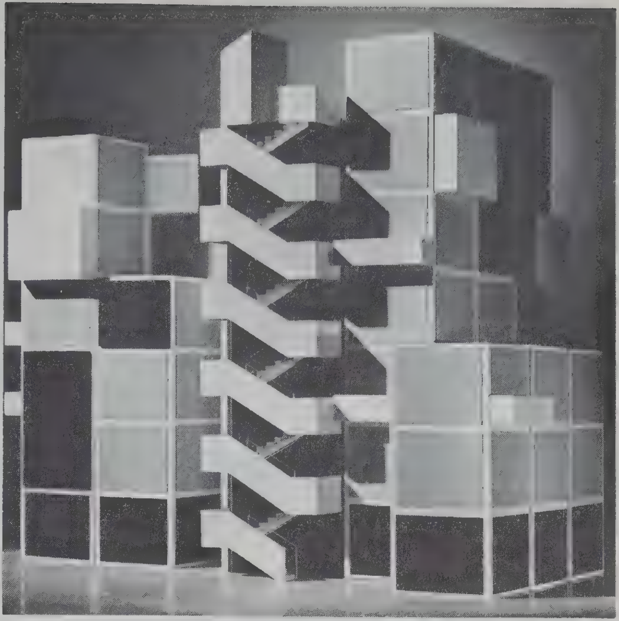
This corporation has long been associated with the mobile home industry as a supplier of lightweight structural steels for the underframes of mobile homes as well as with the fabricating industry. It has often worked in cooperation with mobile home manufacturers in the design of frame construction. Jones and Laughlin felt that members of the mobile home industry, based on what they have accomplished in the housing field, were in a leadership position to supply the needed manufactured space.

Their new design concepts were first presented as an exhibit at the 1967 MHMA Suppliers Show at the Navy Pier in Chicago in September. The design concepts were graphically illustrated using models, color renderings, and photographic enlargements of Dalton-Dalton's architectural sketches.

All of the concepts, including multi-family units for high density areas, single family units, and vacation homes, suggest methods whereby the new concepts can be made psychologically competitive with conventional housing, while retaining the economic appeal of a mass-produced, fully-furnished, ready-to-occupy dwelling which is hauled from the factory to the site as a ready-to-position unit. Estimated costs of these concepts range from $9 to $12 per sq ft delivered to site. These costs are slightly more than those of the conventional mobile home, but they are a great deal less than conventional construction.



High rise apartment building is a steel skeleton frame containing individual residence units. Equipment on roof permits fast erection and remodeling. Units of differing lengths avoid "slab-sided" effect.



Units with sturdy steel framework are shipped horizontally, then tilted to a vertical position. One unit may contain utility core, another a stairway or elevator. This system permits buildings of up to six stories.

The High Rise Concept

A proposed high rise apartment building consists of a steel skeleton frame containing individual residence units. Hoisting equipment on the roof or ground permits fast initial erection and facilitates subsequent interchangeability of units for remodeling. Utility service lines and elevators run within a permanent core. The residential units are steel framed, and may contain fold-out sections for balconies. Units of different lengths are used to avoid a "slab-sided" visual effect.

Tilt-Up Units

In the case of the tilt-up concept, 12 ft by 12 ft units with a sturdy steel framework are shipped horizontally, then tilted up to a vertical position on the site. The apartment building takes shape as units are placed side-by-side. One unit may contain the utility core, another a stairway or elevator, while other units allow modular arrangement of rooms. Fold-out balconies provide easily added space as well as visual excitement. Boxes no longer than present mobile homes would form buildings of as much as six stories tall. The steel framework permits rapid and simple erection and bolting together of the units in the field.

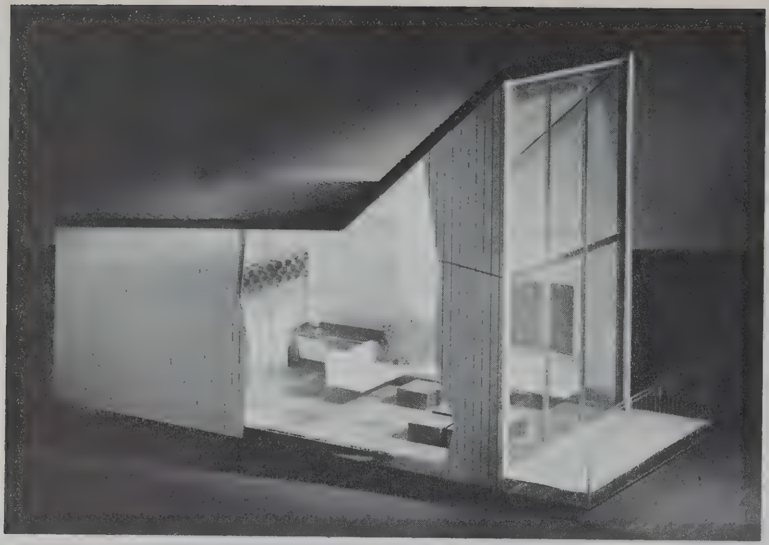
The Town House

The third multi-family, high density concept is the town house. Steel-framed units stacked atop and alongside each other form the basis for the town house complex. Pre-assembled stairways allow stacking to a height of two or three units. These units are staggered longitudinally for a heightened visual effect. Greatly improved soundproofing results from separation of units by their two individual walls, and from the use of vibration-damping pads at all connections. Outside facing can be 2 in. brick, weathered steel, or other siding material. The sturdy steel framework allows application of the facing materials in the factory without fear of damage in transit.

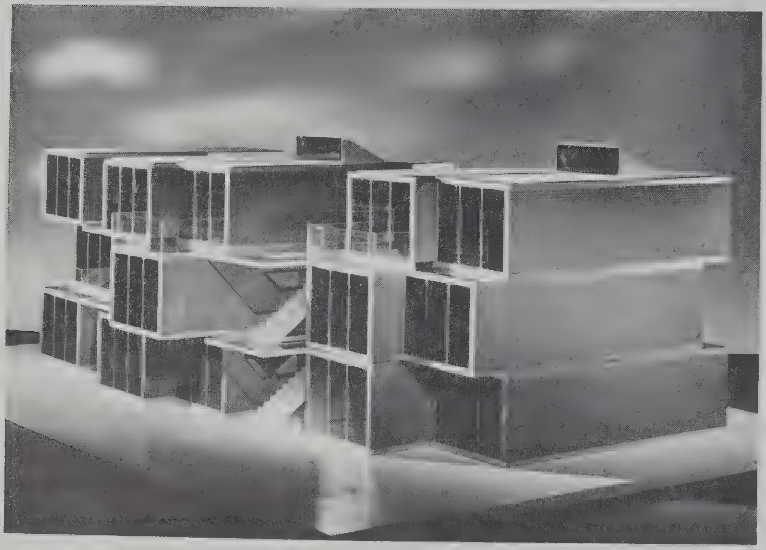
Single Family Homes

Although Jones and Laughlin's primary concern has been with presenting possible directions for the alleviation of urban, high density housing problems, there is also a need for reasonably priced private, second, and vacation houses. The concepts to be described were designed primarily as single family residences. However, each one can be adapted as needed to apartment complexes in high density areas.

One design employs a 12 ft square basic unit with fold out sections on each side. Three units, fitted together, yield a surprising 1,152 sq ft of space. So flexible is the design that one unit may be used as a single-unit cottage or more units may be added to meet the growth of a family. Peaked roof units may be skylighted or shingled. The lightweight steel frame



Cathedral windows in high end permit entrance of breeze and sunlight in flip top design. Units are shipped with ends folded down. This type of construction provides a ready answer for the second home market in resort areas.



Town house complex is provided by stacked, steel framed units. Longitudinal staggering gives heightened visual effect. Soundproofing results from separation of units by two walls and from use of vibration-damping pads.

carries all loads and permits all four walls to fold up. When sides are folded, three units can be shipped on one low trailer.

Another design, called the Flip-Top, is functional as well, because cathedral windows in the high end catch sunlight or a prevailing breeze. Two, three, or more of these units can be combined. Three 12 ft by 24 ft units yield an 864 sq ft area. Units are shipped with the front ends folded down, yet the steel framework insures structural rigidity in transit and on site. One immediately apparent application for this design is the growing "second home" market in summer and winter resort areas.

In the Cross-Stack concept, several lightweight steel framed units are stacked at right angles. Three 12 ft by 36 ft units yield a total of 1,296 square feet. Upper units are connected to form a double width living room-kitchen-dining area. The lower unit employs a fold-out wall section in the bedroom area, and its roof forms a sundeck. Cross-Stack design creates a covered carport or play area.

All of these designs illustrate the directions which are being explored. Each mobile home manufacturer's unique design, fabricating, and marketing approach, will, in its individual way, bring us closer to our mutual goals in satisfying the housing needs of the nation.

Conclusion

What is in store for the mobile home? The Mobile Homes Manufacturers Association feels that the modular design prefabrication techniques are an advantage in the new housing field. Stacking mobile homes into town houses, or placing them into high rise skeletal structures is something that the Association knows can be readily accomplished. The compliance, for the most part, with codes, the prefabrication techniques, and the favorable construction time would seem to be a practical answer to the tremendous problems of housing that face our country today. ☐

Mr. Radigan received his LL.B. from the Columbus University School of Law.

Research on Precast Concrete in Medium-Rise Apartments

NEARLY ALL TRULY PERMANENT construction is designed and built on a custom basis in order that each building be tailored to the needs and desires of its owner. The constructors of buildings are highly segmented administratively. Therefore, almost none of the contemporary tools of management science and industrial engineering can apply. Yet, all the craftsmanship and expertise reside in this large group of independent entrepreneurs.

Past efforts to improve upon the existing state of affairs have resulted in such devices as common plans from which many buildings are conventionally constructed, and in factory prefabrication of panels from which buildings can be assembled. These efforts either represent almost no technological change or they move counter to the construction industry establishment. Therefore, they have had little effect.

What is needed is the superimposition of mass production techniques over the existing construction industry. As a result, the advantages of mass production could be realized while applying the talent which currently exists and without causing undue reorientation during the introductory process.

To indicate that real benefits can accrue from this hypothesis, a parallel can be drawn with the automobile industry wherein one custom made, prototype automobile may cost as much as $500,000. When mass produced, most Americans can afford such an automobile on a modest family budget. Not only can the buyer afford an automobile, but he can specify modular features which make his car suit his private and individual desires.

Since it implies a sense of security in the mind of the occupant, a residence must have a much longer life expectancy than an auto. Therefore, the huge market and rapid rate of obsolescence observed in the auto market will never be acceptable in the residential construction market. Nevertheless, the residential need is presently for six million units, a market large enough to support a well developed, mass produced residence industry.

One of the major deterrents to the appearance of a sophisticated residential mass production industry is not covered by this study. That deterrent is the lack of assurance to the entrepreneur that he can claim a large enough segment of the existing market to profitably amortize his initial capital investment in plant and equipment. To the conservative construction industry the risks appear to be too high in relation to the pay-off potential.

Since low-income people currently have the greatest need for housing in the United States, the research program on which the report is based was specifically directed towards low-income housing. The conclusions reached, however, are generally applicable to the problem of how to reduce the cost of multi-story housing construction.

BERT FOWLER, Research Engineer, Mechanics Research Division, IIT Research Institute, Chicago, Illinois.

A universe of possible solutions is available for selection to solve the problem. However, it is necessary to define more clearly the constraints, limitations and characteristics of those solutions before rational candidates can be formulated for evaluation. This definition presents the following questions:

Which pieces or parts are really required to form a dwelling unit and how can those necessary parts be used most effectively?

What have other investigators done in these areas?

Is the candidate system amenable to rational structural engineering analysis and design procedures?

How can American expertise in mass production be applied practically to housing construction?

What will be the reactions of craftsmen, contractors and building officials to departures from conventional building techniques?

How can the economic merits of candidate solutions be assessed accurately?

Finally, can the solution be organized in such a manner that the resulting residences will be the kinds of places in which low-income people will want to live?

The Program

The work described in this report is Phase I of a proposed two phase Low-Income Housing Demonstration program. The total program has the goal of developing and demonstrating a construction method which will reduce the costs of low-income housing.

Phase I is concerned with all required studies prerequisite to the construction of a full scale experimental prototype model of the derived construction method. In Phase II it is proposed first to construct and structurally test prototype units and then to erect a demonstration building. The demonstration building is intended to substantiate the validity of the predictions established during Phase I.

All Phase I work was done in the laboratories of IIT Research Institute in Chicago, Illinois. It is anticipated that the Phase II demonstration building will be erected on the campus of Illinois Institute of Technology, near 35th and State streets in Chicago. Chicago is a desirable site for this demonstration because the local weather requires that buildings be designed for rather severe extremes of both hot and cold temperatures. In addition, the building code and trade union functions in Chicago are representative of the large metropolitan complexes of the United States, and the need for low-income housing is greatest in the metropolitan areas.

A program plan for Phase I was established to include an examination of housing techniques developed by others; a description of the conceptual construction system; the determination of the trade union and building code attitudes regarding the concept; development of the construction system, including structural evaluation; and the determination of the economic, aesthetic, and manufacturing feasibilities.

Approach Definition

Workable solutions for the housing problem have been sought for many years in the United States and abroad. An extensive literature survey revealed more than one-hundred reports and articles on prefabricated housing. This information was classified into the following areas: prefabrication systems, joining techniques for load bearing walls, design techniques and analyses, and modeling techniques.

Several noteworthy successes of industrialized building may be observed in Europe. Perhaps the most successful is the Bison system, currently enjoying wide usage in the United Kingdom. A careful study of the stated problem areas was launched in order to select among the following options:

1. Adopt and modify a successful system from abroad for use in the United States.

2. Develop an altogether new system tailored to the needs and industrial atmosphere in the United States.

3. Attempt to further streamline conventional United States techniques without major modification to the basic approach.

It was learned early in the program that building contractors and manufacturers of contractors' equipment are continually making advances which streamline conventional methods in a way that has brought the industry to a high level of sophistication within the scope of present methodology. Therefore, the third option above was removed from contention and attention was turned towards the remaining two. The approach to Phase I of the program embraces parts of each of the first two options.

Design Concept

During the preproposal research, the case for factory assembly was established and the three-dimensional module was revealed as the most promising candidate vehicle for factory assembly. At the same time, concrete was selected as the material for initial study because of its inherent fire resistive characteristics. This decision is not meant to imply that other materials are not equally suited to modular construction. The decision was made in order to simplify this first examination of the problem area. Within the framework established above, there were several potential means through which the three-dimensional concrete module could be formed.

One of these methods involved cast planes of concrete (two-dimensional elements) for assembly into three-dimensional elements (modules) during the factory assembly operation.

Another consisted of cast tri-planar elements resembling the intersection of two walls and a ceiling or two walls and a floor for assembly into rectangular prismatic room-sized modules during the assembly operation.

A third employed cast small elements resembling rooms cut into segments by passing a series of vertical cutting planes through at suitably short intervals.

The fourth solution called for cast monolithic room-sized modules. The modular form chosen was the monolithic room-sized unit.

The rationale used in selecting the precast monolithic module considered the following requirements to be essential: capability of mass production, multiple use of functional parts, rational design procedures resulting in the required degree of structural integrity, and easy handling with available machinery.

As a result of these requirements, the three-dimensional monolithic module evolved as the best candidate. It could be designed in small enough dimensions and weight to be manageable in precasting and factory assembly operations. By virtue of having walls, the module provides the structure to support the building loads. The walls are aligned one on top of the other vertically, so that a large bearing area is maintained throughout the height of the building. This large support area reduces unit stresses to a low enough level that four inch thick walls with minimum reinforcement (as required to resist thermal cracking) will safely sustain buildings over twenty stories in height.

The Apartment Plan

Before the exact geometry or configuration of the monolithic module could be determined, it was necessary to study apartment floor plans. Therefore, the architect team member developed apartment layouts to determine the range of module sizes suitable for residential application within the constraints of shipping size and weight.

As a result of this study, the module size established was 23 ft long, 12 ft wide, and 8 ft 4 in. high—all outside dimensions. Three apartment sizes were also selected for building planning: one, two and three bedroom.

Building Plan Studies

After the module size and selected apartment layouts were determined, building floor plans were studied. The apartment plans were arranged in a wide variety of geometric shapes in order to evaluate the degree of flexibility available.

It was determined that the apartment mix and plan shapes are virtually unlimited but that a square plan was perhaps the most awkward to arrange. For this reason the square plan with a central core was selected for further study.

Module and Building Configuration

After overall module dimensions, apartment layouts, and building plans had been selected, studies were begun to determine the optimum arrangement of the modules. During the course of the study, five stacking arrangements were considered. The scheme selected consists of stocks of modules, 12 ft wide and 23 ft long, with the stacks spaced 12 ft apart. Precast reinforced concrete floor slabs, 12 ft wide and 23 ft long, are placed between the stacks. Prefabricated end walls (curtain walls) 12 ft long complete the enclosure.

The central core of the ten story prototype building contains service facilities, elevators, and a double stairway. The core is conventionally constructed of reinforced concrete. Corridor floors and roof are precast reinforced concrete slabs.

On the first floor, the one bedroom apartments are eliminated and building entrances, vestibules, and meeting or storage rooms are incorporated into the module and slab areas.

The foundation is to be of the drilled caisson or driven pile type.

The decision to select this scheme was based on economic and structural evaluations of the five alternatives. Economic evaluations were conducted by the general contractor team member by comparing cost estimates for each hypothetical modular scheme with a similar conventional design. After the first modular scheme was estimated, a cost comparison was made between it and a subsequent scheme to test the cost effectiveness. Structural evaluations were performed by IITRI through the use of models fabricated from gypsum plaster, aluminum sheet, and microconcrete. The models were loaded in a universal testing machine using electrical resistance strain gages and direct digital data acquisition techniques. At the same time, analytical studies were generating numerical analysis results from studies of edge loaded plates, with and without door and window openings and with a variety of assumed edge conditions.

Joining Techniques

A study was made to determine the most suitable method of joining the stacked modules. Two methods were considered. The first employed an adhesive system using mortar, and the second was a mechanical system using steel shapes cast into the modules for welding at erection.

A survey of mortar bonding strengths was made and a series of tests was performed to determine the most suitable mortar consistency (flow), surface condition (wet or dry), and joint forming technique.

Joining of the modules by welding is a relatively straightforward operation and the casting of weldments into the modules presents no difficulty. However, the structural investigations performed indicate that the module is sensitive to the support provided and, further, that optimum performance is achieved when a full perimeter mortar bed is used to provide continuous support.

Aesthetic Considerations

To assure that these multi-story buildings would be desirable residences for low-income people, a number of design considerations were made. All ducts include sound absorbing liners sufficient to attenuate noise transmission to an acceptably low level. All apartments are laterally separated by a four inch thick, hard surfaced concrete wall to attenuate through-wall sound by more than 50 dB. Provision is made for air intake and power for individual room air conditioning units. Windows are washable from the inside without removal and without precariousness.

Convenient laundry facilities are provided with water heaters separate from those used for kitchen and lavatory. Carpeting is provided throughout to attenuate impact noise transmission vertically. Wooden base and wall cabinets can be provided in each kitchen. A complete exterior insulation envelope is provided to eliminate condensation and drafts from structural sources.

Water closets are anchored to structural elements physically separated from adjoining apartments, and acoustical barriers are included around vertical pipe runs to eliminate objectionable flush noise. Windows are double glazed to eliminate condensation and drafts from that source. Individual water heaters for kitchen and lavatory use are provided for each apartment so that individual family needs are served. Finally, corridors are wide enough to accommodate conversation benches.

Union and Building Code Surveys

Coincident with the module development efforts, local trade union and building code information was collected by personal interview.

The reaction of the affected crafts of the trade unions was predictable to some degree. Union officials were very cooperative and helpful but insisted that the work which has historically been performed by field crafts remain within their jurisdiction. There was no objection to performing this work in a factory except that field union labor and shop union labor could not be mixed.

The information provided by union officials was used to establish a workable manufacturing procedure. Discussing the building system concept with the unions during the planning stage as opposed to the usual after-the-fact confrontation was helpful in obtaining their cooperation, suggestions and interest.

Interviews were held with the various building authorities in Chicago including those concerned with electricity, plumbing, fire, and safety. Most large cities adopt one of the national model codes, or incorporate the wording of the model codes in their local code. Processes for adoption of materials by the model code authorities is rational and fair. Since the materials to be used in the prototype building are not unusual in high rise constructions, no code problems involving materials were expected. The module construction technique, although revolutionary, can easily be demonstrated as structurally adequate by code accepted analytical and experimental methods.

Manufacturing and Assembly

The general contractor and the precaster team members provided the background data for developing plant operation procedures and precasting techniques. This information, combined with the findings of the IITRI building code and trade union studies, provided the basis for the total system characterization.

The system developed was basically a three step operation: precasting, final assembly or finish, and erection. A precasting firm would furnish the unfinished modular units to the general contractor who would install the finish material and equipment in a factory environment and subsequently transport and erect the finished modular units. The use of mass production and off site assembly techniques is basic to the success of the building method developed in this program.

Cost Studies and Effectiveness

In order to determine cost effectiveness for the modular system, estimates were prepared for two identical ten-story apartment buildings, one constructed using the module and one conventionally built using flat plate concrete floors and reinforced concrete columns. The module or prototype building was faced with a latex plaster system. Concrete masonry units with face brick were assumed for the conventional system.

Both estimates, including material take-off and pricing, were prepared by the contractor and precaster team members along with active, selected subcontractors as necessary. The estimates were for complete, ready-to-occupy buildings except that site development, kitchen and laundry appliances, and a refuse disposal system were not included.

In addition to the above estimates, all of the contracting firms were asked to provide cost information assuming volume production for the prototype. Volume was defined as 1,000 precast modules per year. The firms were hesitant to prepare actual estimates but unanimously agreed that there would, indeed, be a saving of between 10 and 15 percent because of increased efficiency.

The cost estimates for conventional, prototype, and volume construction are shown and compared in Table 1. Note that the costs for the three generalized portions of the work are shown separately and combined to show their relative contribution to the total cost. The costs per square foot are: conventional, $16.30; modular—prototype, $15.80; and modular—volume, $14.22.

The conventionally constructed building is approximately three percent more expensive than the prototype building and 15 percent more than volume construction.

A time related savings must be added to these direct savings. The completion time for the prototype build-

Table 1

COST COMPARISONS OF CONVENTIONAL,
MODULAR PROTOTYPE,
AND VOLUME CONSTRUCTION

	Conventional	Modular, Prototype	Modular, Volume
General Contractor and Precaster	$1,092,104	$1,043,094	$ 940,100
Electrical Contractor	171,106	188,217	169,400
Plumbing Contractor	112,900	102,900	90,500
Total Contract	$1,376,110	$1,334,211	$1,200,000

ing is estimated at eight months, compared to 14 months for the conventional building. This time saving amounts to approximately 40 percent. The interest saved on construction financing is approximately three percent of the total cost or approximately $40,000. This time related item increases the savings for the prototype to six percent and for the volume production to 18 percent. Also, because of earlier occupancy, the property becomes income producing sooner; however, this factor was not considered in this report.

Structural Evaluation

Literature was searched for structural analysis techniques and experimental study results. Having found nothing entirely applicable, a computer program was selected for rigorous numerical analysis of the structural response of modules. A series of graduated model sizes were selected to experimentally study the structural characteristics of the modular shape and to determine the effect of scale. Analytical methods provide a quick, economical method of characterizing stresses in great detail when boundary conditions are well defined. Experimental techniques characterize boundary conditions quite well, but cannot define stress patterns in as great detail or with as much accuracy as can be done analytically. By relating the experimental and analytical studies a complete stress history of the module was developed.

The structural analysis was based on the module, modular arrangement and building taking into consideration the following assumptions:

Walls and floors: 4 in. thick.
Uniform bearing by all modules.
Wind load: 30 psf.
Live load: 40 psf.
Partition load: 20 psf.
Dead load: as computed.
Unit weight of lightweight reinforced concrete: 100 lb/cu ft.
Compressive strength of concrete (f'_c): 4,000 psi.

Investigation of the gross structure indicated that the height of the building as limited by overturning and sliding due to wind pressure was 200 stories. Gravity load analysis resulted in a maximum compressive stress at the base of the first story walls of 131 psi for the ten-story prototype structure. This stress is about one-sixth of the code allowable of 1,000 psi. Compressive stress resulting from combined gravity and wind loads was determined to be 188 psi. Computation of the buckling resistance of the walls under a combined wind and gravity loading indicated an allowable stress far exceeding (170 times) the actual stress predicted.

Flexure, shear and bond stresses in the wall elements are:

	Computed	Allowable
Flexure	140 psi	1,800 psi
Shear	5 psi	75 psi
Bond	64 psi	500 psi

The area of reinforcing required in the wall elements of the module, based on the maximum moment due to wind, is 0.05 sq in./ft; however, the area required for temperature reinforcement is greater. Number 3 bars on 12 in. centers in both directions is adequate.

Results of the floor element analysis are:

	Computed	Allowable
Flexure	866 psi	1,800 psi
Shear	16 psi	75 psi
Bond	118 psi	485 psi
Deflection	0.35 in.	0.38 in.

The area of reinforcement required in the floor is 0.40 sq in./ft for main reinforcement and 0.071 sq in./ft for temperature reinforcement. Number 5 bars at 9 in. centers and No. 3 at 12 in. centers provide the reinforcement necessary.

The results of the structural analysis, discussed in the preceding paragraphs, were based on an empirical approach. In order to substantiate this approach, wall elements were further analyzed using the two-dimensional theory of elasticity. This more rigorous method also provided information regarding stress patterns and concentrations and was used to determine the applicability of analytical computer methods to this structural shape.

The computerized finite element method of analysis proved that the use of approximate or empirical methods is sufficiently accurate for design purposes. Also, the highest factor determined for localized stress concentrations, which occur at the inside corners of doorways, was 3.02. Applying this factor to the average compressive stress of 131 psi yields a localized compressive stress of 395 psi which is well below the allowable.

Several other aspects of structural behavior were investigated including earthquake analysis, foundation studies for four soil conditions, and module and slab connection and joining.

In addition to the analytical methods of analysis previously discussed, experimental modeling studies were performed on sixteenth scale aluminum models and on quarter scale concrete models with aggregate and reinforcing to scale. These studies were designed to indicate difficulties inherent in the fabrication of monolithically cast prototype size modules and to establish stress intensifications localized in the neighborhood of openings such as windows and doors.

They were also intended to examine some of the assumptions used in the structural analysis with regard to stress flow in the stacks of modules and to identify potential problem areas not specifically attacked in the formal structural analysis. These limited objectives were satisfied in a generally satisfactory way.

Conclusions

The monolithic, three-dimensional module is structurally sound and can be analyzed and designed by ordinary engineering methods by employing a rational set of assumptions. Commercially available, non-shrinking grout used as mortar for bedding the modules appears to be a simple yet effective method of joining.

The cost estimates show that the prototype building should cost six percent less than the same building constructed by conventional methods. For the short range, when production reaches 1,000 to 2,000 modules per year, the cost should drop to 18 percent below conventional.

Modular construction was estimated to reduce construction time by 40 percent, thus reducing the term of use of construction funds. This accounts for a three percent cost reduction below that of conventional construction because of savings in interest charges. That such a large time reduction is realistic has been substantiated by a recent project in San Antonio, Texas, where the time savings was quoted by the contractor as being precisely 40 percent.

Building codes are not particularly constraining. Modular construction can be easily designed to meet the requirements of the code of any large city. This includes areas subject to earthquake and hurricane hazards.

Factory assembly of residential modules is not objectionable to trade unions if the plant employs local, union craftsmen performing their historic trades at prevailing wage rates for the craft.

A precasting firm should manufacture the structure of the module, but the final assembly should be under the control of a general contractor, assisted by appropriate subcontractors, for the various specialty areas This arrangement permits utilization of available craf skills in the efficient environment of a factory where all desirable power tools and material handling aids are available. Negative effects of weather are virtually eliminated.

From the standpoint of architecture, modular construction has little influence, since modular constraints are loose enough that any residential arrangement can be accommodated. Therefore, the suitability of structures which can perform as residences for low-income people is a function of the knowledge and talent of the architect for each specific building project.

The modular system meets all of the objectives set for it in the beginning. The only requirement left unfulfilled is some type of market guarantee so that risk capital can be channeled into this worthy area. The second phase of the demonstration program may reveal some answers in the financing area, as well as further substantiate the primary objectives of the Phase I conclusions. ☐

Mr. Fowler is a member of the Building Research Institute. A Registered Architect and Structural Engineer in Illinois, he received his B.S. in Civil Engineering from Purdue University.

Exterior Wall Systems and Materials for Multi-Family Construction

THE MAINSTREAM OF BUILDING RESEARCH and development activity in the next decade will focus upon low and middle income housing in the nation's cities. The construction industry's health and growth are closely related to the vitality and prosperity of these cities and their metropolitan areas. The challenge is to provide more and better housing at lower costs. An opportunity is now present for the industry to participate in a tremendous market while helping to restore and maintain the health of ailing communities. If we are to solve the problems that have been spawned by urban blight, we must pay attention to construction subsystems as well as to the prime systems.

The exterior walls of most of the high rise apartments in this country are masonry cavity walls, consisting of 4 in. of brick, a 2 in. air cavity that is generally uninsulated, and 4 in. of concrete block. The concrete block is generally faced with plaster or gypsum board. The 10 in. composite has a U value of about .27. Its fire resistance is four hours which is substantially more than that required by most codes. Most non-load bearing exterior walls used in multi-family construction need only be incombustible, or, in some cases, have fire ratings of one hour or less.

The economics of this type of wall in a metropolitan area in which there is a high cost of labor may be seen in Table 1. Under favorable conditions, the time required to erect such a cavity wall is about two days per floor. Considering the body of knowledge that has been gained in erecting more expensive office building exterior wall systems, it is somewhat frustrating that the industry has not taken advantage of the savings in erection time that can be realized with metal or precast concrete curtain wall systems, with which it is not unusual to be able to enclose an entire building in one fifth of the time required for masonry construction.

Time is money in construction. Considering the economics of low cost industrial curtain walls, it is baffling that the industry has not been able to develop less costly new systems for multi-family housing. It would seem that, to lower total costs, it will not only be necessary to develop new wall systems, but to devise means to lower the ratio of field labor to material costs, to overcome the difficulties posed by a shortage of competent masons in various areas, and to take advantage of the efficiency that can be possible if a greater portion of the fabrication is done in the factory.

Table 1

ECONOMIC ANALYSIS OF A MASONRY CAVITY WALL IN A TYPICAL "HIGH COST" METROPOLITAN AREA

Item	$ per sq ft
Brick work, jumbo common, @ $70/M	$1.40
4 in. cinder block @ $156/M sq ft	.54
Mortar	.05
Reinforcing (every third course)	.02
Washdown and point up	.07
Scaffold rental	.05
Shelf angles	.20
Gypsum board interior finish	.32
Contractor's overhead, profit, taxes and miscellaneous	.28
Total	$2.93

JOSEPH H. NEWMAN, Vice President, Tishman Research Corporation, New York, New York.

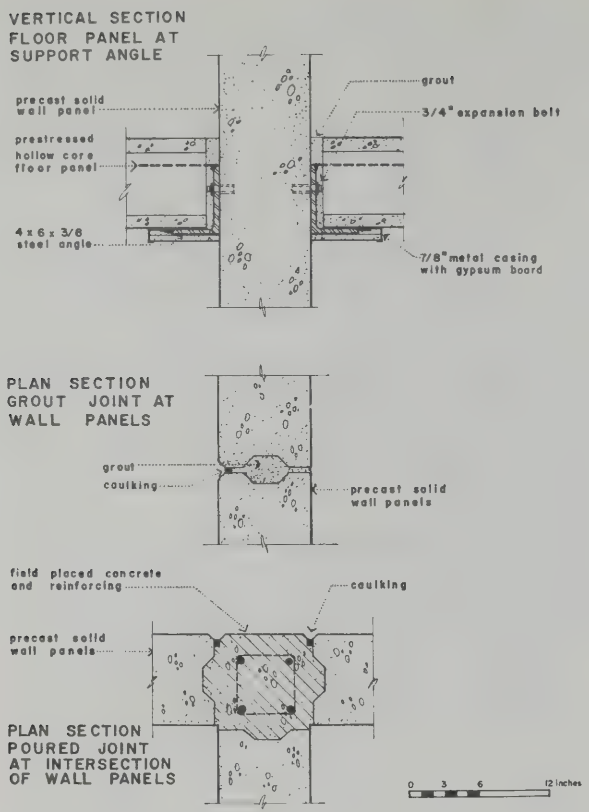

VERTICAL SECTION FLOOR PANEL AT SUPPORT ANGLE
precast solid wall panel
grout
3/4" expansion bolt
prestressed hollow core floor panel
4 x 6 x 3/8 steel angle
7/8" metal casing with gypsum board
PLAN SECTION GROUT JOINT AT WALL PANELS
grout
caulking
precast solid wall panels
field placed concrete and reinforcing
caulking
precast solid wall panels
PLAN SECTION POURED JOINT AT INTERSECTION OF WALL PANELS
0
3
6
12 inches

Figure 1. Precast concrete bearing and bracing wall.

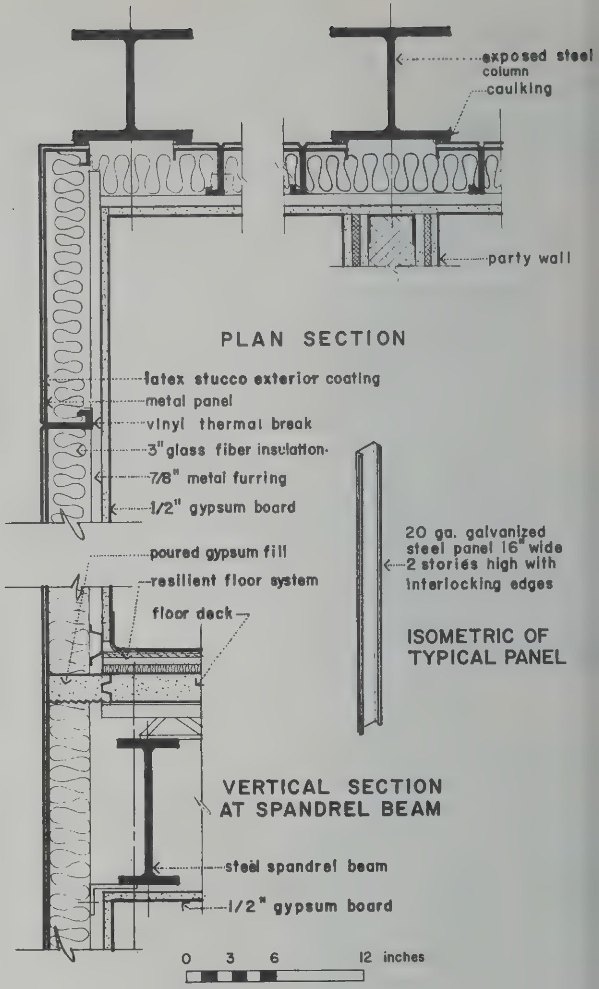


Figure 2. Steel panel industrial type wall.

Economic Goals

A practical economic target appears to be the development of a \$1.75-\$2.00 per sq ft curtain wall. Such a goal is realistic, and at the same time the cost is sufficiently lower than current masonry costs in high cost metropolitan areas so as to provide a real sense of competitive urgency to the masonry interests. Further, the stimulation of competition in an area of building in which there is so little must ultimately be beneficial to the consumer.

At this juncture, credit must be given for the stimulus for such an objective to the Cost Reduction Techniques for Low Income Apartment Houses project sponsored by the U.S. Department of Housing and Urban Development. This research and development project was implemented by the Pratt Institute School of Architecture with help from the Ford Foundation. The development activity completed under this program indicates that \$1.75-\$2.00 targets are attainable.

It is appropriate to mention that there are avenues of economy available to the masonry interests, but they do not seem to take them seriously. For example, high-strength mortars are commercially available which permit the construction of single wythe walls to which may be laminated an organic foam and a dry gypsum board. A wall consisting of single wythe masonry, an insulating material, a cavity, and a self-studding gypsum panel is another approach. Such construction has the potential of being less costly than a conventional cavity wall.

The Pratt Project

The Pratt project explored four wall systems. The first consisted of precast concrete bearing and bracing walls, 3 ft-4 in. and 6 ft-8 in. wide, 8 in. thick, and two stories high. The inside faces were covered with foamed polystyrene insulation and gypsum board finish, both of which were job-applied by adhesive.

The structural system was composed of 8 in. thick, 3 ft-4 in. wide, prestressed, precast, hollow-core, light aggregate slabs. These spanned between the bearing panels. Supporting these floor panels were steel angles bolted to inserts in the wall panels. These angles were fire protected with gypsum board. The system is shown in Figure 1. Tying the structure together were field grouted joints and field welded and grouted tie strips and bars. A temporary bracing system of wood 4 by 4's was used to hold and plumb the wall panels during erection, before they could be released by the crane. Clearly necessary for a tall building would be an efficient and quick system of adjustable supports so that the crane could be occupied with lifting and placing, not holding. Also clearly indicated was the necessity of accuracy in placement since there was difficulty in fitting some of the floor slabs between the walls. The

8 in. by 8 in. poured joints were cumbersome to form and place and would be better precast.

The principal difficulty with the concrete structure was the floor to wall joint, which involved an unsightly projection at the ceiling where the supporting angle and its fireproofing occurred. Also, the wall panel joints were not acceptable visually and the joints between the floor panels, exposed on the ceiling, were on the margin of acceptability. If this system were to be used in a 20-story building, the use of room-sized wall panels one story high would be preferable. In this case, the floor panels would rest on top of the wall panels, thus eliminating the supporting angle.

A second system explored utilized steel panel industrial type walls consisting of channel shaped panels of 20-gauge galvanized steel, 16 in. wide by two stories high, with interlocking caulked joints. This system is pictured in Figure 2. Two types of panels were used, one flat and one formed with a channel shaped depression. On the exterior was a coating of latex modified cement stucco, factory applied. The panels were fastened with self-tapping screws to sheet metal angles welded to the steel structure. Glass fiber batt insulation was placed inside the panels between the ribs. Metal furring strips and ½ in. gypsum board formed the interior finish. A gypsum fill was poured between the metal panels and the floor deck to provide sound and fire stopping.

During erection, some difficulty was experienced with alignment of holes in the panels with holes in the supporting angle. The time consuming method of temporarily bolting the angle in place and then welding it must be improved before this system is used in a tall building. After the panels had been up a short time, a tendency to spread was noted at the top which could be counteracted by bolting the panels together at the flanges. The general appearance of the panels was not too satisfactory. The flat panels had a tendency to bow inward while the scale of the formed panel was rather coarse for a residential building. In addition, there were through openings to the weather at the sill and at the door jamb, which should be eliminated.

A third system employed a lightweight concrete exterior wall. Figure 3 shows the details. These walls were precast in a factory pilot plant in panels 4 ft wide, 3 in. thick, and one story in height. Expanded polystyrene beads were used as a light aggregate in a foamed concrete, to which sisal fiber had been added for tensile strength. The material weighed 25 lbs/cu ft. The exterior and interior surfaces of the panels were coated with a factory applied acrylic coating, fiber reinforced on the exterior. The joints between the panels were splined with 3 in. by ¼ in. cement asbestos strips, and were calked on the outside and mortared on the inside. The panels were attached to the steel structure by means of steel Ts in the spline joint attached to angles which were in turn fastened to the structural members. The interior joints were taped, spackled and painted. This system showed good promise, but the manufacturer decided not to offer this product in the market place.

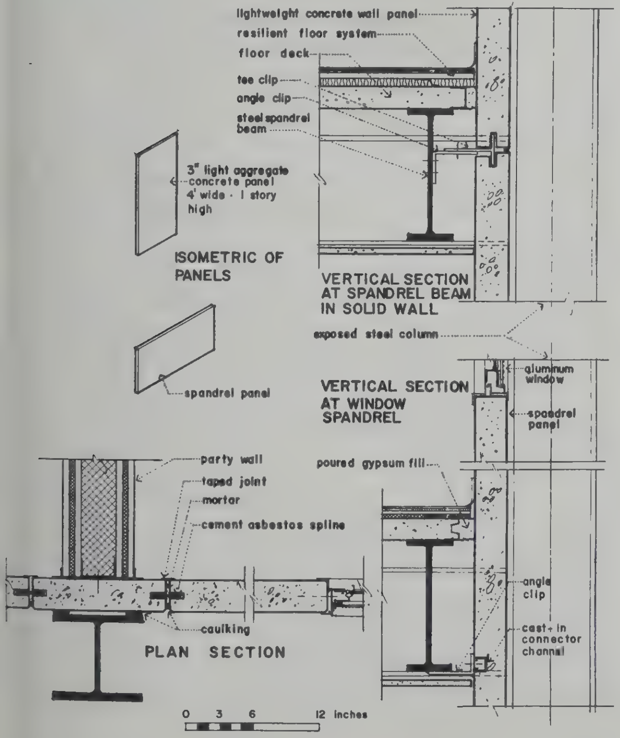


Figure 3. Lightweight concrete exterior wall.

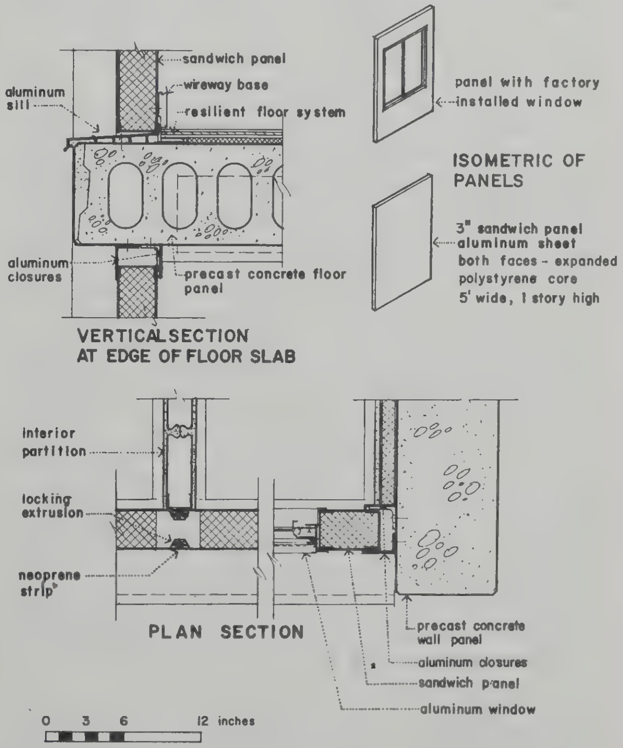

sandwich panel
wireway base
aluminum sill
resilient floor system
panel with factory installed window
ISOMETRIC OF PANELS
3" sandwich panel aluminum sheet both faces - expanded polystyrene core 5' wide, 1 story high
aluminum closures
precast concrete floor panel
VERTICAL SECTION AT EDGE OF FLOOR SLAB
interior partition
locking extrusion
neoprene strip
PLAN SECTION
precast concrete wall panel
aluminum closures
sandwich panel
aluminum window
0 3 6 12 inches

Figure 4. Aluminum sandwich exterior wall.

An aluminum sandwich exterior wall was used in the fourth system. It is shown in Figure 4. This wall was a shop fabricated panel of enameled aluminum sheets adhered to a 3 in. thick core of foamed polystyrene. The panels were 5 ft wide by one story in height. They spanned without mullions between the floors of one side of the concrete wing. The joint between the panels was closed by a chloroprene rubber strip inserted with a special tool on the interior and exterior faces. There was no through metal-to-metal contact in the panel. Both the chloroprene rubber strip and the aluminum, finished with a baked enamel, were exposed on the interior and exterior. The joint between the panel and the concrete floors was formed of aluminum extrusions fastened to the concrete and calked. There was no objection to the appearance of the aluminum extrusions with fastenings exposed in the interior.

The least costly of the four wall systems utilized the precast lightweight aggregate. The cost of this system was about $1.70 per sq ft of opaque area, in place. The other non-bearing wall systems were similarly priced, at a little over $2.00 per sq ft of opaque area. The load bearing concrete panel wall (as a system) was the most costly one.

There were aesthetic objections to the aluminum and steel panel systems, but it is not fair to preclude their further consideration because no effort was made to explore design variations in combination with other materials, or alone. The experimental work did point up the need for more work on the development of improved erection procedures and detailing. Also, resulting from inconsistencies between field and laboratory pre-testing, the need for fire research became quite apparent.

A Practical Application

Following the Pratt activity, and springing from independent work by one manufacturer, an economical curtain wall system was developed that has since become commercially available and has been demonstrated in full scale on a 13 story dormitory, Bromley Hall, at the University of Illinois, Champaign, Illinois. This system adapts techniques and principles used in consistently warm climates, modified to satisfy the environmental requirements of changing temperatures and freeze-thaw conditions. Although not fully prefabricated, there is enough organization and on-site fabrication to result in significant economies. In this system, as used in Bromley Hall, panels were fabricated on each floor and stored there until ready for use. Each floor actually becomes a miniature panel factory. When the required number of panels were completed, simple templates, built of plywood and 2 by 4's, were moved to the next floor and the process was repeated. Materials used were heavy gauge metal studs, ½ in. gypsum sheating, metal lath, screws, ⅝ in. gypsum wallboard, and fibrous insulation. The curtain wall was fabricated in 5 ft by 8 ft panels installed from the inside of the building, eliminating the need for expensive scaffolding. The design was such that the curtain wall became a chase wall so that heating and cooling piping could be run vertically at the exterior columns through the chase space to the convectors under the windows. The interior wall frame of 1⅝ in. metal studs is tied to the curtain wall with screw-attached gussets of gypsum sheathing. The interior face was ⅝ in. foil backed gypsum board.

By varying size and spacing of studs, walls of various heights may be constructed to withstand wind loads of more than 15 psf. Interior and exterior facings in various combinations allow for aesthetic and functional flexibility. A reduced stud load is a definite advantage.

In the construction, 20-gauge metal runner tracks are secured to top and bottom structural members with power driven fasteners. Twenty gauge metal studs are attached to runners, with screws, one at each side of runner track, top and bottom. On the building floor, wood templates hold the studs and the sheathing in place, while the self-furring metal lath is screw attached. The sheathing is attached horizontally to each stud with screws, 8 in. on center, as is the lath. Insulating blankets are positioned between the studs and are secured in place by stapling through the blankets into the gypsum sheathing.

For the interior face of the exterior wall, gypsum board is applied vertically or horizontally and attached to each interior stud with screws, 8 in. on center. In case of a wall without a chase the interior face is attached directly to the common stud. Gypsum lath and plaster interiors may also be used.

Control joints are spaced not more than 10 ft on center, horizontally and vertically. They are attached to the sheathing with staples, or with wire tied to metal lath. Sheathing and metal lath are discontinuous under control joints.

Portland cement stucco is applied in three coats to a thickness of one inch. The stucco contains latex. For brick veneer construction, brick ties are attached to studs with screws. The application of stucco opens new dimensions for architects.

Its use is made possible by the addition of latex to the stucco mix. This gives the stucco the capability of withstanding freeze-thaw cycles and eliminates cracking and spalling. Extremes of temperature and moisture are no longer a problem. The latext provides better bond to the substrate and imparts improved overall durability.

This system also permits the addition of wings or fin walls by prefabricating these from studs covered with metal lath and screw attached with runners.

By sheathing the building first, there is the advantage of being able to start interior work earlier and of working in inclement, cold weather. The total cost of the system is a little over $2.00 per sq ft of opaque area.

Another System

Another curtain wall system has been developed by the applied research laboratory of a major corporation.

This system uses an existing residential exterior wall panel as its basic component. This panel, the frame of which is fabricated from an 18-gauge galvanized carbon steel roll-formed "Z" shape, is modified for high rise applications by the replacement of the fiberboard sheathing with a noncombustible board, and by the addition of a light gauge, paint embossed steel face sheet adhesively laminated to the exterior sheathing. These plain exterior panels are used in conjunction with a standard window subframe that is capable of receiving a variety of commercially available window units. Both panels and window subframes are installed in a floor-to-ceiling application between sheet steel spandrel covers. These spandrel covers act as a weep system for the entire curtain wall by draining any water that might enter through the primary seals of all joints. The use of continuous preformed gaskets at the head, sill, and vertical joint between panels simplifies the erection and forms a positive weatherseal at all the joints.

Many variations in the appearance of the system are possible, and the designer has great freedom in creating a wall suitable for his particular building. The spandrel-cover profile can be changed without affecting the panel-installation details. The cover can be either flat, curved, or have one convex protrusion or a series of convex protrusions. Vertical emphasis can be achieved by using massive column covers, by changing the profile of the exterior batten, or by carrying the vertical batten line past the plane of the spandrel cover. The designer is not restricted to lining up the vertical joints or the panels from floor to floor, and he can therefore arrange the panels in any order without affecting the joint conditions of the panels above or below.

All components can be erected entirely from the interior of the building. The panels and window components are easily handled by two men and are tilted into place from their respective locations. The vertical closures, formed by an interior and exterior batten, are attached to the panel and are secured and made weathertight as the panels are erected.

Full scale mock-ups of the new wall have been erected to test the erection procedure and the performance of the system. A full scale two-story test specimen, 16 ft wide by 21 ft high, was erected at the University of Miami Housing Research Laboratory, Coral Gables, Florida, and was subjected to the full series of National Association of Architectural Metal Manufacturers air and water infiltration tests.

The air leakage was well within the allowable limits, and the individual head, sill and vertical curtain wall joints showed no signs of leakage during both the static and dynamic water infiltration tests. A detailed cost analysis and marketing survey of this system is being made and cost reduction studies are continuing.

There are many other approaches and variations of those discussed. A variation of the approach used at Bromley Hall, under study by one company, calls for the application of about one inch of latex modified stucco to all sides of a polystyrene foam slab, to form a panel.

Trends in Developing Wall Systems

A trend appears to be emerging. For the first time in modern building product history, serious efforts are being made in many places to develop low-cost wall systems for multi-family housing. It is interesting to note that the major portion of this development activity is coming primarily from raw material suppliers, building product interests, and sophisticated builders, and not from the traditional curtain wall contractors and fabricators who sell to the commercial market. These groups claim that they have too big an investment in tooling and that they do not want to develop a system that will sell for considerably less than the ones they are selling now. However, unless they change their thinking, they risk the possibility of eventually facing competition from wall systems for housing, some of which, with relatively minor modifications, will be suitable for commercial applications. These wall systems will sell at a fraction of the cost of the systems now in use.

The most successful exterior curtain walls for housing of the first generation will have seperate components for exterior decoration and protection, for insulation, and for interior facing. The second generation of exterior walls for housing will combine or integrate the insulating, fire resistance, decorative, and structural functions to a greater degree.

Systems using inorganic foams with integral facings, extruded asbestos-cement with a natural appearance, self-supporting cementitious and gypsum components, ceramic glass shapes, and aluminum and steel are now inevitable. Historically, windows and window systems were developed independently of the wall system. This will change. A good window can help make a wall system and development will progress simultaneously.

The non-load bearing wall will remain dominant, primarily because it will be less costly when considered in terms of the total context. Too, multi-family housing will look less and less alike.

Finally, in answer to those who say that the exterior walls in a building represent only a small percentage of the total construction costs so why concentrate on them, the point can be made that savings, no matter how small, add up and that the wall is a good base upon which to develop broad system thinking. The day will soon come when we will earn to integrate plumbing and mechanical systems effectively in wall systems in order to achieve major dollar savings. First, however, we must meet the more basic challenge. ☐

Mr. Newman is a member of the Board of Directors of the Building Research Institute. He is also a member of the Building Research Advisory Board and of the Advisory Panel to the Building Research Division of the National Bureau of Standards. He received his B.Ch.E. and M.Ch.E. from the Polytechnic Institute of Brooklyn.

The Metal-Edge, Gypsum Plank Floor System

THE METAL EDGE GYPSUM PLANK FLOOR SYSTEM is experiencing a renewed popularity accompanied by some interesting innovations, thanks to the cooperative effort of two research facilities working as a team. The development work was stimulated through the enthusiasm and direction of an architect and an owner-builder consultant. The School of Architecture, Pratt Institute, and the Tishman Research Corporation were seeking cost reduction methods for low income, high rise housing under a Housing and Home Finance Agency and Ford Foundation grant.

It is interesting to note that, as the development work progressed, there was no requirement for new components in the assembly. The bar joist has been available as a structural framing member for years. Metal edge gypsum plank has been produced since 1934 and was used by chain stores as a floor deck until World War II curtailed the use of metal. Noncombustible sound deadening board has been available as long as waterfelted ceiling boards have been used, and gypsum mastic floor overlayment has been produced since 1934. Its principal use has been as a resilient wearing surface in industrial plants, replacing the old pine blocks and pitch. The drywall ceiling has been an accepted item in commercial construction.

As the research project has developed, outside consultants and laboratories have been used in conjunction with the test programs. Structural tests have been witnessed and reported by Wiss, Janney, Elstner & Associates of Northbrook, Illinois, fire tests have been conducted at Underwriters' Laboratories, Inc., and sound tests have been conducted at Cedar Knolls Acoustical Laboratories and at the U.S. Gypsum Company's research sound facilities. In the latter case, Bolt, Beranek and Newman, Inc. of Downers Grove, Illinois were the consultants.

Table 1

FIRE HAZARD CLASSIFICATION OF COMPONENTS IN METAL EDGE GYPSUM PLANK FLOOR SYSTEM

	Flame Spread	Fuel Contributed	Smoke Developed
Gypsum Mastic	0	0	0
Sound Deadening Board	25	25	5
Metal Edge Gypsum Plank	0	0	0
Sound Attenuation Wool	25	20	0
Gypsum Wallboard	15	15	0

In the Pratt Project, the criteria were established as conventional residential loading, the floor-ceiling fire rating as one hour, airborne sound transmission as a 50 STC, and impact sound as an INR-O.

Building codes require noncombustible materials for high rise structures. Table 1 indicates the fire hazard classification of the components. All are rated as noncombustible.

Testing programs were set up to include fire, airborne sound, impact sound and structural aspects.

Fire and Sound Tests

Figure 1 illustrates the basic construction assembly as the base from which building code approvals may be gained. The fire test assembly failed at 2 hours and 40 minutes by temperature rise at a single thermocouple on the deck.

Airborne and impact sound tests have been referenced to the typical reinforced concrete flat plate floor system and to the dry floor assembly. They are shown in Table 2. The more sophisticated dry floor constructions incorporate sound deadening board placed be-

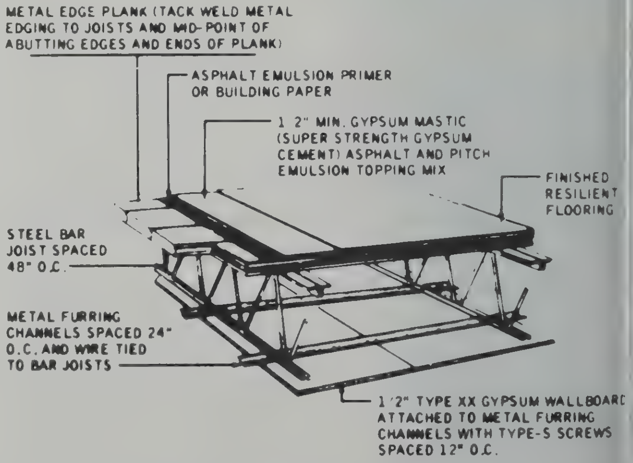

METAL EDGE PLANK (TACK WELD METAL EDGING TO JOISTS AND MID-POINT OF ABUTTING EDGES AND ENDS OF PLANK)
ASPHALT EMULSION PRIMER OR BUILDING PAPER
1 2" MIN. GYPSUM MASTIC (SUPER STRENGTH GYPSUM CEMENT) ASPHALT AND PITCH EMULSION TOPPING MIX
FINISHED RESILIENT FLOORING
STEEL BAR JOIST SPACED 48" O.C.
METAL FURRING CHANNELS SPACED 24" O.C. AND WIRE TIED TO BAR JOISTS
1/2" TYPE XX GYPSUM WALLBOARD ATTACHED TO METAL FURRING CHANNELS WITH TYPE-S SCREWS SPACED 12" O.C.

Figure 1. Basic construction assembly for fire tests.

EARL ELLWOOD, Manager, Architectural and Construction Services, United States Gypsum Company, Chicago, Illinois.

Table 2

RESULTS OF AIRBORNE AND IMPACT SOUND TESTS

Type of Construction	Weight	Laboratory	INR Rating	STC Rating
9 in. Reinforced Concrete, Flat Plate	100	FHA #750	−17	48
Dry Floor System (as fire tested)	25	Cedar Knolls	−14	48
Dry Floor System plus ½ in. Sound Deadening Board and 1⅛ in. gypsum mastic	32	Cedar Knolls	− 4	50
Dry Floor System plus 1 in. Sound Deadening Board and 1½ in. gypsum mastic	35	USG Lab BBN	+ 1	53

tween the metal edged gypsum plank and the gypsum mastic overlayment. The gypsum mastic varies in thickness as required for a wearing surface over the low density sound deadening board as well as for additional mass important in sound isolation.

Structural Characteristics

The physical properties of the metal edge gypsum plank are as follows:

1. Size—2 in. by 15 in. by 10 ft weighing 11.8 lbs per sq ft.

2. The galvanized edge configuration is fabricated of 22-gauge sheet metal, with a section modulus of 0.130^3 in. and a moment of inertia 0.132^4 in.

3. The water repellent core has a 1,000 psi.

4. The core is reinforced using 16-gauge 4 in. by 4 in. wire mesh.

5. The uniform load table for bar joist spacing ranges up to a maximum of 4 ft. At these spacings and loads, the deflection will not exceed 1/360 of the span or induce flexural stresses greater than 20,000 psi in the metal edging.

6. Concentrated loads were applied to the metal edge gypsum plank at the geometrical center of the 4 ft span, following the ASTM test procedure E 72-61. Figure 2 records the deflections as the loads were applied to the 1 in. diam disc.

7. Impact loading on the metal edge plank produced a 1.5 in. initial deflection with a .15 in. set at 180 foot pounds. Failure occurred on a wet plank with a punch through at 600 foot pounds.

The sound deadening board is a mineral fiber, water-felted product with an 18 pound density. The gypsum mastic overlayment is a high-strength gypsum consisting of 100 lbs of gypsum and 3 cu ft of sand aggregate with asphalt emulsion additive, developing a strength of 1,000 psi.

Shear Tests

Horizontal shear tests were conducted at Monroeville, Pennsylvania, on a test frame consisting of two bays of 22 ft, 10 in. by 24 ft. A structural steel frame of H columns and I beams supports 14 in. bar joists spaced 4 ft o.c. and spanning 22 ft, 10 in. The metal edge gypsum plank was welded in accordance with specifications.

The load was applied in increments of 1,000 lbs at the midpoint and the reaction to this loading was equally divided between the two ends. The frame was loaded several times to 10,000 lbs and the test data indicates that the floor system remained in the elastic range through this loading. Prior to 19,000 lbs, nothing unusual was noted. At 19,500 lbs, localized crushing of the gypsum plank was noted in the vicinity of the concentrated load points. At 38,000 lbs, the slab reached its yield point. An inspection revealed no weld failures and no continuous cracks running through several planks. The slab was still considered serviceable.

Shear contribution of the plank with no gypsum mastic or ceiling construction was calculated as 830 lbs per foot of diaphragm depth. The engineers had calculated that a load of 6,840 lbs on the frame represented a wind load of 30 mph.

Response to Vibration

While human response to vibration cannot be measured exactly, investigators have proposed a scale in terms of maximum particle velocity of the floor as

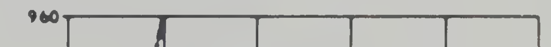


Figure 2. Deflections caused by concentrated loads applied to metal edge gypsum plank.

disturbing, strongly perceptible, distinctly perceptible, slightly perceptible, and imperceptible.

The dynamic response of the metal edge gypsum plank floor, based on panels tested, was ranked from strongly perceptible to first cycle vibration and distinctly perceptible to dampening after 0.5 sec. Since the panels were not restrained along their longitudinal edges, as would be the case in practice, the field performance was judged to be distinctly perceptible to the first cycle vibration and slightly perceptible to dampening. Partitioning and other loading can be expected to reduce the final installation to slightly perceptible and imperceptible.

Erection

The erection of the components follows accepted construction practices. The bar joists are erected and bridged in the usual manner. Openings are framed in accordance with standard structural design requirements.

The metal edge gypsum planks, tongue and grooved on all four edges, are erected in the manner of wood flooring. End joints are staggered and there is no requirement for end bearing except at openings. Under the normal live and dead load requirements, the plank can cantilever up to 1 ft, 9 in. The plank can be cut in any direction using the standard hand power saw with a carborundum blade. It is estimated that on a properly stocked floor, as much as 2,000 to 2,500 sq ft of plank can be laid per man per day.

The Welding Process

The welding process is of interest. U.S. Steel's Welding Research Division recommended a short arc, automatic wire feed technique. The 0.035 in. silicone bronze wire with argon gas shield provides an efficient and effective weld. A tack weld of the leading metal edge of the plank to the joists can be accomplished by one man as fast as the plank can be laid by a crew. The actual tack weld requires from 8 to 10 seconds. Once the deck is down and in place, a welding pattern of 2 ft o.c. at each joint is required but this may be minimized with future changes in the metal edge configuration.

The sound deadening board in 4 ft by 4 ft panels is merely laid in place with edges tightly butted and scatter nailed in place.

The sound deadening board must be protected with a water-resistant membrane in order to maintain the fiber resilience after the gypsum mastic has set.

The gypsum mastic is poured in place and screeded off to the required thickness. This material has a set of approximately four hours, and it can be used as a working surface in 24 hours.

Costs

Cost estimates were provided by the consulting contractor for the Pratt Project which is to be built in Philadelphia, a 20-story housing project. Table 3 shows the breakdown of the projected costs on the project.

Table 3

DETAILED COST ESTIMATES PER SQUARE FOOT FOR STEEL FRAME-DRY FLOOR ASSEMBLY

Structural Steel	$ .93
Bar Joist	.21
Welding	.08
Metal Edge Plank	.55
Furred Gypsum Wallboard	.40
Gypsum Mastic (½ in.)	.20
Painting Wallboard	.07
	$2.41
Fireproofing Steel and Premium for Extra Building Height	.47
	$2.88
Sound Deadening Board (½ in.)	.13
Additional Topping (⅝ in.)	.06
	$3.07
Sound Deadening Board (1 in.)	.07
Acoustical Topping (⅜ in.)	.05
Total	$3.19

The Engineering News Record, in an article published in the December 22, 1966 issue, quoted a $500,000 cost savings accruing as the result of a redesign from an initial, flat plate reinforced concrete structure, to a structural steel frame and metal edge gypsum plank construction, in the Cricklewood Apartment Project in Pittsburgh, Pennsylvania. It is difficult to rationalize a saving of this amount on a 240,000 sq ft project.

In the escalating labor market it is to be expected that the cost advantage of the dry floor construction will improve, since the use of shop fabricated units reduces substantially the cost of on-site labor.

Dollar savings in terms of an earlier date of occupancy must be substantial since all trends in recent years have stressed speed of erection. A reduction in time of construction should range from two to four months.

Another cost factor, not related to the initial construction cost, is maintenance. Continuing maintenance on decorative partition surfaces has proved to be considerably less when a structure is steel frame rather than reinforced concrete. Apparently, the detailing allows less structural stresses to be transmitted to the non-load bearing partitions, reducing the irritation of tenants because of unsightly cracks, and the problem of repairing and redecorating the damaged areas.

It is simple to understand enthusiasm for the metal edge gypsum plank dry floor assembly when it is realized that the gypsum industry has had a meager 18 cents per sq ft in gypsum products in today's typical high rise structure. The industry is looking forward to an increase of 185 percent in tomorrow's market.

Mr. Elwood holds a B.S. in Civil Engineering from Michigan State University.

Human Response to a Residential Acoustical Environment

As POPULATION AND NOISE LEVELS increase in our urban areas, the provision for acoustical privacy in dwellings is attracting increasing attention. Home builders, manufacturers, architects, and engineers are striving for more effective measures to reduce noise intrusion in dwellings.

In 1964, the National Housing Center Council of the National Association of Home Builders initiated a "Quiet House" program. As a part of that program, the NAHB Research Foundation, Inc., published a Residential Sound Conditioning manual. While this manual was being prepared, it became evident that there was little factual data on the in-place acoustical performance of floors, walls, appliances, and mechanical equipment and systems. Even less information was available on the degree of satisfaction of the occupants in relation to the acoustical environment in their dwellings. Yet these types of infor-

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RALPH J. JOHNSON, Staff Vice President, NAHB Research Foundation, Inc., Rockville, Maryland.

mation are fundamental to the development of products and to the good acoustical design and construction of homes and apartments.

The NAHB Research Foundation, Inc., has now completed a field study of residential acoustics. The study was sponsored by the NAHB, along with Armstrong Cork, General Electric, Johns-Manville and the NAHB Research Foundation, Inc. It is a continuation of a long-range program by the NAHB, the Foundation, and the building industry to identify problems and to search for cost-effective solutions to achieve a greater degree of occupant acoustical satisfaction. It is a follow-up to a similar pilot study that indicated the feasibility of measuring in-place acoustical performance and of obtaining meaningful responses of the occupants.

The purposes of this research were to determine in-place acoustical performance of walls and floors, background sound levels, and the sound levels produced by appliances, mechanical-electrical equipment and plumbing systems; to determine occupants' reactions to their acoustical environment; and to evaluate the results to identify problems that might be solved by new or modified products, construction, design, planning and/or installation details.

Research of this nature is almost unique in the United States. Similar studies have been conducted in European countries, and, although they are interesting, they are not directly applicable in this country because of substantial differences in construction, materials, designs, background sound levels, and living habits of the people related to noise production.

The research took place in a 98-unit garden apartment project in the Washington, D. C., area. The four three story buildings studied were built in 1966 by the builder-owner. Rents ranged from $125 per month for a one bedroom unit to $175 per month for a three bedroom unit, plus the cost of electrical service.

Construction

Construction details are as follows.

Exterior walls and terrace level longitudinal center-bearing walls are load-bearing masonry. There are five types of interior party walls all faced with gypsum board: 2 in. by 4 in. staggered studs, 2 in. by 3 in. staggered studs, 2 in. by 4 in. studs, 8 in. masonry, and 3⅝ in. steel studs.

The floor-ceiling construction consists of wood joists, 1 in. by 6 in. board subfloor, ½ in. thick wood fiberboard (laid without adhesive or nails), ½ in. oak block flooring set in mastic (ceramic tile in bath and vinyl asbestos in kitchen), full-thick mineral wool insulation stapled between the joist spaces, light gage steel resilient ceiling suspension channels nailed to the underside of the joists, and ½ in. gypsum board attached to the resilient channels.

Apartment entrance doors are hollow-core metal with spring-actuated hinges.

Each apartment is equipped with a gas-fired, force
air furnace and an electric air conditioning unit. Duc
are sheet metal. Kitchens are equipped with a refrige
ator, dishwasher, garbage disposer, range hood and fa
gas range, and oven.

Cast iron DWV piping and copper water supply pipin
are used and sponge chloroprene rubber "bushings" is
late supply piping from the structure in most cases.

Physical Measurements

The acoustical performance of the dwellings was d
termined by making the following measurements:

1. The airborne sound isolation provided by the se
eral types of party walls and floor-ceiling assemblies.

2. The ability of the floor-ceiling assembly to redu
the transmission of impact-generated sounds.

3. The levels of existing background noises as th
varied with the time of day. (Background sound leve
are important in relating occupant response because
is only when intruding noise levels rise above bac
ground sound levels that they are perceived by the occ
pants as intruding noise. Background noise levels we
measured both in furnished and unfurnished apa
ments.)

4. Operating noises were measured of the automa
dishwasher, garbage disposer, kitchen range hood a
bathroom exhaust fans and the air-conditioning syste
Noises produced by flushing the water closet and filli
and draining the bathtub and lavatory were also me
ured within the dwellings and in adjacent dwellings.

Determination of Occupant Response

For the part of the study dealing with occupants'
sponses, a professional marketing and opinion resea
organization was engaged to cooperate in the design
a carefully prepared questionnaire which was pretest
Professional interviewers then visited occupants to
tain their responses to the acoustical environment. T
questionnaire was designed to elicit the desired inf
mation and to avoid any kind of bias. It contained f
levels of degree of stimulation with respect to acousti
varying from "nothing" to "substantial."

Results of Acoustical Measurements

All physical measurements were conducted in acco
ance with recognized standard test methods except th
measurements for which no standard test method exi
In those cases, measurements were made using te
niques representative of the best current methods.

Noise Reduction (NR) measurements between roo
provide results that closely approximate the acousti
separation heard by occupants and include all sou
flanking paths and leaks. When sound flanking pa
are minimal, the Field Sound Transmission Loss (FT
is determined and the Field Sound Transmission Cl
(FSTC)—a single figure rating—is assigned accord
to the prescribed rules. The FSTC (field) is analog

to the STC (laboratory) single figure rating except that the former applies to field measurements.

Results of the in-place measurements of the four wall types were somewhat as might be expected on the basis of laboratory data on similar but not identical types, i.e., the FSTC's (field) were a little lower than the STC's (laboratory) except where substantial flanking, leakage and/or short-circuiting paths occurred. The FSTC's for walls (where the Field Transmission Loss could be determined) varied from 40 to 56. One living room party wall type showed in-place results about 13 points below what might be expected on the basis of laboratory measurements. This was probably due almost entirely to the sound flanking paths that existed through the acoustically poor entrance door assemblies that were adjacent to the party wall and opened on to a reverberant hallway. The doors were not gasketed and had a substantial undercut. Two of the bedroom walls also exhibited sound leakage or flanking characteristics.

In general, at least three repetitions of measurements were made of all party-wall constructions having nominally identical designs. In all instances, data were obtained and analyzed in third-octave-frequency bands. This method is considered to be highly important in the analysis and interpretation of the data because the definition provided by the narrow frequency bands (⅓-octave) reveals leaks, wave coincidence phenomena and related information; and, in some cases, certain construction types can be improved when specific weaknesses are thus revealed.

Walls of the same type did not always exhibit the same results at all frequencies, which is not unusual. Differences of 7 or 8 dB were encountered in the FTL at some frequencies although the resultant single-figure FSTC's were usually within a 2- to 3-point range. Where walls were free of leaks, flanking paths minimal, and the rooms well defined, field transmission loss results were comparable generally to laboratory results in repeatability and accuracy. In some instances, noise reduction between rooms separated by nominally identical walls varied to a greater degree. In one case, a difference of 23 dB was observed at one frequency (1600 Hz). The curves of the noise reduction data, of course, showed the effects of sound leaks and flanking paths if they were present.

It is concluded from the results of this and previous studies that field acoustical measurements are far more difficult to perform than laboratory measurements, and, sometimes, the results are more difficult to evaluate because the many variables that are known and/or controlled in the laboratory must be separately measured and evaluated in each and every field measurement situation. Obviously, this causes field acoustical investigations to be considerably more expensive than similar laboratory tests but, of course, field measurements are the only method to determine in-place performance.

Airborne noise reductions between rooms in vertically adjacent apartments were measured. Field Sound Transmission Class (FSTC) varied from 51 to 57 and, apparently, provided satisfactory airborne sound isolation through the floor-ceiling assembly between apartments.

Measurements also were made of the sound pressure levels radiated into the lower room resulting from floor impact excitation on the floor above. A single-number Impact Noise Rating (INR) was assigned by comparing the measured impact sound pressure levels with a reference curve according to a set of prescribed rules. INR varied from +2 to +4 for the basic floor-ceiling assemblies without carpeting or rugs.

A floor tapping machine was used to radiate impact sound pressure levels into the room diagonally below. In this case, sound pressure levels (ISPL) varied from 5 to about 20 dB less than when the impact source was directly above the receiving room. In general, the larger differences occurred in the higher frequencies, and the least difference occurred at 315 Hz.

Ambient background noise levels were measured in the same unfurnished rooms that were involved in the measurement of the acoustical performance of party walls and floor-ceiling assemblies. Data were accumulated over a period of several weeks, and most of the measurements were made between 4 p.m. and 7 a.m. The background data reported did not include operating noise of heating and air conditioning systems.

Background noise levels rose between 4:30 and 7:30 p.m. with a characteristic increase in traffic noise and then ranged downward to below the threshold of hearing during the late evening and early morning hours in some instances. Maximum background sound pressure levels during those hours did not exceed the noise criterion curve NC-30. The background noise level range was mostly below NC-25. In general, the background noise levels were quite low.

Measurements of the noise produced by mechanical equipment and appliances were conducted in a furnished model apartment. Measurement included sound pressure levels of the garbage disposer, kitchen range hood fan (ductless), air conditioning system, automatic dishwasher, bathroom exhaust fan, and bathroom plumbing noises. The noises produced were recorded on magnetic tape and later analyzed in third-octave frequency bands. Noises varying with time, such as the cycling of a dishwasher or the flushing of a water closet, were analyzed in "A-weighted" sound levels (which approximates the human ear response) and were plotted as a function of time using a graphic level recorder. Full-octave frequency band levels were also determined as a function of time.

A precise picture of noise levels can be obtained only by examining the plot of sound pressure levels against frequency and, in some cases, against time. An approximate idea of the results obtained is contained in the following statements.

The high sound pressure level for the garbage disposer was 67 dB and occurred at 5000 Hz. For the kitchen range hood fan, the significant high of 59 dB occurred at 630 Hz which is in the speech interference frequency range. The sound pressure levels for the air conditioning system were substantially above the nighttime background noise levels and were in the range of NC-35 to 40 noise criterion curves.

The automatic dishwasher reached overall sound levels of 75 dB for short time periods (excluding momentary higher levels of solenoid sounds). During the 6-min. wash cycle, the overall sound level was 73 dB and the A-weighted level was 69 dB. The most sound energy was in the 250 to 2000 Hz range—i.e., within the speech interference range. Interestingly enough, the A-weighted sound level versus time plot shows that, during the wash cycle, the sound level rises about 35 dBA above the ambient and that there are momentary fluctuations of 9 to 10 dBA occurring between operational cycles.

The bathroom-exhaust-fan high was 61 dB at 500 Hz and generally ranged between 50 and 60 dB. The high for the water closet flushing occurred at the beginning of the cycle and averaged about 64 dBA (about 25-30 dBA above ambient). Filling the lavatory produced the highest bathroom sound with a sound pressure level of 76 dB in the octave band centered at 4000 Hz. This sound ranged between 48 and 76 dB, generally increasing from 125 to 4000 Hz. Filling the bathtub produced a sound pressure level that ranged from 48 to 67 dB, generally increasing from 125 to 4000 Hz.

Subjective Response of Occupants

Final judgment of satisfactory acoustical performance is ultimately pronounced by the consumer, that is, the occupants. For this reason, the Research Foundation believed it was necessary to obtain subjective responses of the occupants.

A questionnaire was most carefully designed and pretested to reflect accurate responses. No mention of the words "sound" or "noise" was made before the tenth question. Many questions allowed the respondent to respond in his own words. Finally, of course, very specific factual information was obtained to detailed acoustical questions. Both male and female occupants were interviewed.

On the average, the families had occupied the apartment for about three months. Of the 78 families interviewed, about 40 percent had moved from homes and 60 percent had moved from other apartments. About half of the families had children, with half of the children under six years of age. In general, the occupants were young, half of them being less than 30 years. About 80 percent of the occupants had professional, clerical or sales occupations. Most liked their apartments, including the location, site plan, design, conveniences (including the appliances and air conditioning) and the privacy.

When asked what they did not like about their apartment, about one-fourth referred to acoustics in one way or another.

Despite the fact the builder had expended substantial additional cost on various aspects of sound conditioning, only slightly more than one-third of the occupants stated that they considered the apartment to be "sound-treated."

About three-fourths of the occupants said they did not hear the neighbor's radio or TV sets, and the balance of them were either bothered only "some," "not much" or "not at all." On the other hand, 98 percent of the occupants stated they could hear people walking upstairs. About one-eighth were bothered "very much," about one-third were bothered "some," and 15 percent were bothered "not much," and 38 percent were bothered "not at all."

Walking sounds were most bothersome in the evenings. When asked to describe these impact sounds, the respondents generally reported hearing a "thumping" rather than a "clicking" sound, indicating greater transmission of the low frequency noises.

In general, the occupants were not bothered by outdoor noises. From 80 to 90 percent said they were not bothered by children playing or traffic noises. The noise of the neighbor's garbage disposer could be heard by 73 percent of the occupants responding, 42 percent heard the dishwasher, and 24 percent heard the neighbor's exhaust fan.

When asked about noises from neighbors' kitchens and bathrooms, 80 percent said they could hear such noises. Most of these responses were related to plumbing, although the slamming of kitchen cabinet doors, bathroom exhaust fans, and garbage disposers were also mentioned.

Occupants were asked whether the sound from their own appliances bothered them. Approximately one-third stated "yes" (for the garbage disposer), nearly 70 percent (for the dishwasher when they were in another room), and 59 percent (for the exhaust fan, primarily bathroom).

Plumbing noises from adjacent apartments brought forth disapproving comments from 70 percent of the respondents. However, only 13 percent were bothered by the plumbing noises produced in their own apartments.

In general, about 70 to 80 percent of the occupants seemed satisfied most of the time. However, the impression is that occupants were somewhat less satisfied with the acoustical environment than with other features of the apartment. When asked what they disliked about their apartments, without mentioning acoustics (question No. 4), 28 percent responded with an acoustically related item.

As one might expect, it appears that occupants who once lived in a house were more aware of intruding noises than those who formerly lived in other apartments. The indications are that the latter have become accustomed to certain kinds of noises and, although they are heard, they are not found to be particularly bothersome. However, with certain types of noises, such as plumbing noises originating in other apartments, the indications are that the former apartment dwellers are bothered as much as those who formerly lived in houses. It is interesting to note that in the analysis of the data, the occupants of the top floor were not the most acoustically satisfied, even though impact noise on floors was a primary problem on other floor levels.

As it was mentioned earlier, the survey results indicated that the occupants liked their apartments and community, and most appeared to be satisfied with the acoustical environment in and around their apartments.

The following acoustical problems are listed in order of apparent severity:

1. Impact noises through the floor-ceiling assembly.
2. Plumbing and appliance noises transmitted to other apartments.
3. Noises originating in stairways.
4. Airborne sound transmission through (or around) walls.
5. Noises generated by appliances within the respondents' apartments.
6. Noises from utility areas such as laundries and storage facilities.

With the existing low background sound levels, party walls exhibiting FSTC's in the 47 or higher category produced essentially satisfactory results for the occupants. However, party walls with FSTC's in the vicinity of 41 were not nearly as satisfactory to the occupants.

Transmission of Impact Sound

One of the most significant acoustical problems in multi-family dwellings is the transmission of impact sound through floor-ceiling assemblies. In the apartments studied, the builder had provided practically the maximum feasible sound treatment known for frame construction. The actual in-place acoustical performance was about as would be expected from laboratory measurements. In addition, occupants generally provided rugs and/or carpeting. Yet, 98 percent of the occupants "heard" walking sounds and 13 percent were bothered "very much" and another 34 percent were bothered "some" by floor impact sounds. Based on this tudy and a previous study by the Research Foundation, t is concluded that impact sound reduction through rame floor-ceiling assemblies is a significant problem for research.

Appliances and Plumbing

Another apparent acoustical problem is the transmission of noises, from one apartment to another, produced by appliances and plumbing. In this study, the builder, in a substantial number of cases, had isolated he piping from the framing with resilient gasketing nd had made efforts to fill holes in parts of the floor-ceiling assemblies in and around plumbing drain and upply piping. Still, the most frequently mentioned othersome plumbing noises were water flowing into he bathtub from the tub fill or showerhead, and the lushing of the water closet. Plumbing systems require many holes in the subflooring with the net effect being hat the acoustical isolation provided by the bathroom oor-ceiling assembly is considerably less than that of the surrounding structure. Plumbing supply piping noises were higher than expected due primarily to the relatively high water pressures (75 to 85 psi) and because not all pipe-to-frame contact was removed.

Kitchen cabinet door slamming and slamming of entrance doors were bothersome structureborne sounds. The poor acoustical performance of the undercut entrance doors in reducing airborne sound also was bothersome.

It is apparent that the provision of cost-effective acoustical treatment requires a three-way cooperation between the manufacturer of the product, the workmen installing it, and the builder. For example, the bathroom fan had a flexible connection to the ductwork but the fan housing was rigidly attached to the structure, which enhanced the transmission of structureborne sound. Provision by the manufacturer of a resilient gasket or a resilient system for attachment, proper installation by the workmen and careful supervision by the owner or builder would have helped to reduce this problem. Numerous other similar examples could be cited.

In this study, a building code requirement created a problem. Some of the party walls had 2 in. by 4 in. studs staggered on 2 in. by 6 in. top and bottom plates. However, the building code required blocking in these studs, even though mineral wool insulation was used. Surprisingly enough, the blocking did not significantly affect the ability of the wall to reduce airborne-transmitted sound, but it did apparently substantially increase transmission of structureborne noises, such as kitchen cabinet door slamming.

Theoretically, a 1 sq in. hole in 100 sq ft of wall will reduce the performance of an STC 50 wall to about STC 39. Measurements have shown that a ½ in. diam hole in a masonry wall reduced the STC rating by 7 points.

As it has been pointed out, noise reduction measurements showed substantial variation in performance of apparently identical walls. Analysis of the detailed data indicates that this difference in performance was probably due to sound leakage problems created by improper workmanship or flanking paths. It is apparent that substantial extra supervision is required to achieve installed construction details that will aid in reducing noise problems.

It is concluded that considerably more studies of this type relating in-place physical performance, background sound levels and occupant reaction are necessary to provide the industry with the information needed to develop products, designs, and installations that will yield cost-effective solutions to the acoustical problems in homes and apartments. ☐

Mr. Johnson is a member of the Building Research Institute, the American Society for Testing and Materials, and the United States of America Standards Institute. He received his B.S. in Civil Engineering from the University of Illinois and his M.S., also in Civil Engineering, from Harvard University.

Selected Publications of current interest to the building scientist are reviewed. Please order direct from publisher. Do not order from BRI.

Suggested Reading

BOOKS

Computers in Architectural Design. *David Campion; American Elsevier Publishing Co., Inc., 52 Vanderbilt Ave., New York, N.Y. 10017; 1968, 320 p., $12.50.*

Another volume in American Elsevier's Architectural Science Series, this book is intended to be an introduction to computer techniques for those who wish to learn about computers and their applications in architectural design. The principles expressed, though, are fully applicable to the design process in other disciplines. After a general introduction to computer techniques, currently available computer peripheral equipment, and methods of programming computers, the book deals with several computer applications. Examples of some architectural applications include perspective drawing, network analysis, design brief assessment and analysis, and information scheduling and design simulation. Aspects covered include management applications; the design of hospitals, warehouses, and single story buildings; lift operation; land use; office administration; and cost analysis. It becomes increasingly evident that computers can take over some tedious and repetitive tasks, thereby freeing architects and others to devote their creative abilities to more fruitful ends.

Office Planning and Design. *Michael Saphier; McGraw-Hill Book Company, 330 West 42nd St., New York, N.Y. 10036; 1968, 193 p., $14.00.*

This is a textbook introduction and guide to office planning for achitects and architectural students, as well as practitioners and students of interior and industrial design, interior decoration, office management, and business administration. It covers all of the phases of procedure required in the planning and design of office space for business, institutions, and government agencies at all levels. The author stresses the need to understand the operational aims, the aesthetic goals, and the financial limitations of each design problem and the need to follow through on the design from its building stage to ultimate use. A set of check lists is provided covering all of the aspects of a space planning project. Useable standards are discussed, useful dimensions are listed, and some important do's and don'ts are suggested. A large number of detailed drawings and photographs to illustrate various design solutions to functional problems are included. All the phases of procedure required in the planning and design of office space are covered, and all the aspects of organizing and running a design company are analyzed.

Schools of Prestressed Concrete: Planning, Design, and Construction of Educational Facilities for Schools and Colleges. *Prestressed Concrete Institute, 205 West Wacker Chicago, Illinois, 60606, 156 p., $10.00.*

This is an illustrated volume featuring more than 150 outstanding schools located throughout the United States and Canada. It contains over 200 photographs and 100 line drawings. Included in its subject matter are grade and high schools, colleges, universities, and vocational institutions. The publication is designed for use by the architect, engineer, contractor, school administrator, and lay members of the community school board. It also serves as a comprehensive reference for readers interested in education and construction. The detailed section on construction techniques has application to all types of building utilizing precast and prestressed concrete technology. Virtually every type of precast and prestressed concrete component is depicted. Specific requirements are listed for classrooms, libraries and information centers, auditoriums, cafeterias, and multi-use facilities. Illustrated sections include structures exemplifying school planning, design, and construction. A separate section is devoted to athletic facilities, including gymnasiums, natatoriums, field houses, and stadiums. Detailed appendices trace the development of the industry in Europe and
United States, provide a bibliogra
of prestressed concrete, and list m
organizations and publications
cerned with education and school fa
ities. Current public and private
penditures for construction are includ

**Organic Coatings: Properties, Selection,
Use.** *Aaron Gene Roberts; Natio
Bureau of Standards Building Scie
Series 7. 1968, 187 p., $2.50. (Or
from Superintendent of Documents,
Government Printing Office, Washi
ton, D.C. 20402).*

During the last 20 years, many sig
cant technological advances have b
made in the field of organic coati
Choosing wisely from the array of m
rials that emerge continually from
search laboratories and production li
is a complex task, requiring both
knowledge of what is available and
understanding of where and how th
materials and techniques can best
utilized. This publication attempts
fill this need. It covers a broad ra
of subject matter not previously av
able in a single volume, and it provi
basic principles in a number of
portant areas such as polymer struct
coatings formulation, pigment functi
use of thinners, coating system c
patibility, and theory of corrosi
Each chapter deals with a major a
of the coatings field, including ty
of coatings, properties of synth
resins, selection of coating systems, s
age and safety, application meth
and surface preparation and pretr
ment. A consolidating chapter is a
included, with illustrative examples
solutions to typical coating proble
Interrelationships among the vari
areas of information are indica
through appropriate cross-referenc
in the text. Specific references to F
eral, Military, and other specificati
are given where pertinent, and an
tire chapter is devoted to a quick gu
and summary of Federal specificati
for organic coating materials. A selec
bibliography and a comprehensive in
are provided. Although this book
written primarily to meet the infor
tional needs of the engineer, archit
maintenance superintendent, and c
ings procurement officer, it is so br
in scope that it can serve as a gene
manual and a convenient refere
source to anyone concerned with pai
varnishes, lacquers, enamels, and
lated materials. ☐

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Building Research

THE JOURNAL OF THE BUILDING RESEARCH INSTITUTE / JULY-SEPTEMBER 1968

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Building Research

The journal of the
Building Research Institute

VOLUME 5, NUMBER 3

JULY-SEPTEMBER 1968

IN THE NEXT ISSUE . . .

The October-December issue of BUILDING RESEARCH will contain selected technical papers from recent BRI Conferences.

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Building Science News

BRI Annual Meeting Set for October

The Building Research Institute will hold its annual meeting at the Atlanta American Motor Hotel, Atlanta, Ga. on Oct. 3 and 4. At that time, BRI committees will meet to formulate plans for the coming year, and to discuss the Institute's long-range goals.

New Board members will be elected, and a proposed bylaw change will be voted on. The BRI Board will meet on the evening of Oct. 2.

All members are invited and urged to attend, and are welcome to meet with any of the Institute's technical committees. (BRI committee structure is shown in chart-form on the back cover of this issue.) Information about committee activities is available from headquarters.

At the annual meeting, Joseph Newman, chairman of the research committee, will present a proposal that BRI undertake a new community service project. The research committee proposal suggests that BRI become the official sponsor of an urban development project, working with local officials and community leaders to plan and develop a new urban community. BRI members would contribute their scientific and technical knowledge and experience, and would thus bring to the project the latest research findings in the field of building technology.

Mr. Newman and others will present background information and will explore the feasibility of the proposed project.

Further information regarding the annual meeting will be disseminated to members as plans are developed.

SCPI Moves to Fortress in Suburbia

The Structural Clay Products Institute, which represents the interests of the nation's brick manufacturers, has moved into a new headquarters building whose architect calls it "an essay in brick."

Architect Charles M. Goodman FAIA selected walnut-colored brick masonry for the building, located in the Washington suburb of McLean, Va. The complex incorporates an administration building, consisting of four office pavilions around a central exhibition space, and research laboratories.

In addition to offices, the administration building contains meeting rooms and a library of technical and historical literature on clay products. The research laboratory houses a million-pound testing machine, climate rooms, wind force simulators and a ceramic engineering laboratory.

Institute To Sponsor California Seminars

BRI will conduct six technical seminars in connection with the Annual Building Products Show at Anaheim, Calif. on September 17-19. The seminars will mark the first time that a professional program has been held in conjunction with the show, which is expected to attract some 8,000 members of the building community, including architects, engineers, contractors and building product manufacturers.

The seminar schedule provides for four sessions, each to include three concurrent seminars. Each of the six topics will be repeated once, thus allowing registrants to attend any four of the six sessions. Topics include constructio
sealants, roof bonds, glass in buildin
design and construction, energy an
lighting as elements of building desig
precast and preassembled concrete sy
tems and components, and buildin
design programming.

The seminars are open to all inte
ested persons. Registration fees are $1
per session for BRI members and $1
for non-members. Those wishing
attend may register at the Anahei
Convention Center, or may pre-registe
by writing to BRI headquarters.

New headquarters for SCPI

Pursifull to Head ASTM Committee

Ross W. Pursifull AIA, BRI memb
and an associate with the Detroit arch
tectural firm of Smith, Hinchman a
Grylls, Inc., has been elected chairma
of the American Society for Testing a
Materials Committee C-24, "Buildi
Joint Sealants."

ASTM C-24 is a 150-member comm
tee responsible for establishing stan
ards related to oil and resin-base caulk
emulsion compounds, solvent relea
compounds, curing, test methods a
specifications for chemically-curing co
pounds, tapes, structural, compressi
seal and pipe gaskets for the buildi
trades.

Pursifull, a member of BRI and
participant in several of the Institut
conferences, was chairman of t
ASTM committee which prepared U
Standard Specification for "Two-Co
ponent Elastomeric Sealing Compoun
for the Building Trades."

Vilar Becomes Editor of *Building Construction*

J. Anthony Vilar, a member of t
BRI Board of Directors, and form
Executive Vice-President of the Ins
tute, is now Editor of *Building C*
struction magazine, published by t
Cahners Publishing Co., Inc.

Vilar moved into the post upon t
departure of Robert G. Zilly, also a B
member, who left the magazine
August to join the faculty of the U
versity of Nebraska's College of
gineering as an associate professor
construction science.

In addition to serving on the B
Board, Mr. Vilar is a member of t
US National Committee for the Int

national Council of Building Research, Studies and Documentation; the American Concrete Institute, and the Construction Specifications Institute. Educated in Paris, he holds a degree in architectural engineering from the University of Edinburgh, as well as a bachelor of arts from the Institution de la Salle, Paris. He held positions with several leading architectural, engineering and contracting firms before joining BRI as Executive Vice-President.

ASTM Requests Flooring Test Methods

Thes American Society for Testing and Materials has issued a request to producers, consumers, materials suppliers and others interested in resilient floor coverings, for methods of testing such coverings.

The request comes from ASTM's ommittee F-6, charged with responsiility for development and standardizaion of nomenclature, definitions, and ield and laboratory test-methods for esilient flooring.

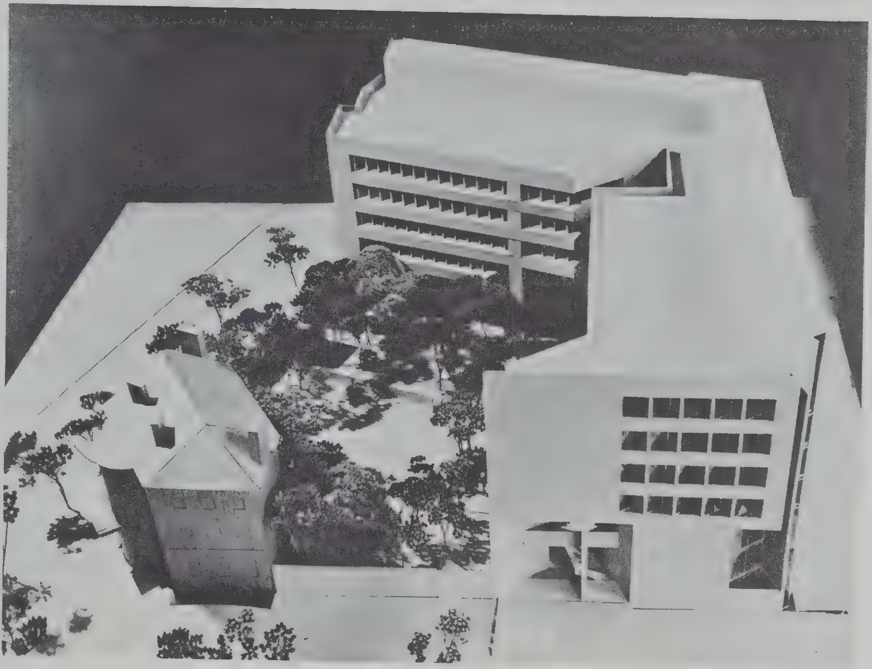
Persons wishing to suggest testing rocedures are requested to write to V. D. Ford, first vice-chairman of Comnittee F-6, c/o Dept. 817, 1916 Race t., Philadelphia, Pa. 19103.

ommission Scotches "Notch" n AIA Headquarters

The Board of Directors of the Amerin Institute of Architects has given onditional approval to the latest veron of the proposed AIA headquarters esign, but has requested its architects do away with a detail which Washgton's Fine Arts Commission doesn't prove.

Mitchell/Giurgola Associates, architcts for the AIA, have been instructed t eliminate the notch where the buildig's two wings join. George Kassalum FAIA, President of the Institute, sd he had received informal word that te Commission objected to the notch, wich would have incorporated a twory, glass-enclosed lobby with an open sice well above.

The current design is the third time aund for Mitchell-Giurgola, selected a project architects in 1964. Members o the Institute have contributed $0,000 toward the new headquarters a restoration of the Octagon House (left foreground) as a public historic monument.



Proposed AIA building design

Industry Promotion Fund Bill to Senate

The House of Representatives passed H.R. 15198, which would amend the Taft-Hartley Act to permit joint contractor-union funds for product promotion, in July. At this writing the bill is soon to go to the Senate.

Taft-Hartley has traditionally outlawed joint control of product promotion funds by unions and management.

The Associated General Contractors of America have vigorously opposed the amendment. Testifying before the Senate Committee on Labor and Public Welfare on S.3149 (twin bill to H.R. 15198), AGC member John E. Healy II stated, "We believe that joint union control over promotion funds is not in the public interest, and that passage of this bill . . . poses serious dangers to management's basic rights to manage."

The AGC fears that joint promotion funds, once legalized, may encourage labor to demand wage increases to pay for the union contribution to the fund.

Opponents of the legislation also predict that with unions participating in the administration of such funds, the advance of building technology would be hampered by labor insistence on promotion of traditional construction methods and materials, due to the union's desire to preserve traditional work jurisdictions.

AIA Announces Architect-Researchers' Conference

The annual AIA Architect-Researchers' Conference will be held at the Dell-View Hotel, Wisconsin Dells, Wis., on September 25-26.

Outstanding researchers in the building field will present papers at the conference, which will be divided into four segments: research in industry; in the professions; in government, and at the universities.

Among the speakers announced are Ralph Taylor, US Department of Housing and Urban Development; David M. Pellish, Assistant Director, National Commission on Urban Problems; Kenneth Anderson, Acting Chief, Division of Environmental Design, National Park Service; Porter Driscoll Jr. AIA, Director, Architectural Division, Federal Housing Administration; David L. Bonesteel, Assistant Professor, College of Architecture and Urban Planning,

(continued)

Building Science News *(continued)*

University of Washington, and Wolfgang Gerson, Professor at the University of British Columbia.

The conference, which is open to anyone interested in and active in the field of building research, will begin on the evening of September 24 and continue for the two days following. The $35 registration fee includes banquets, refreshments and transportation from the Madison, Wis. airport to Wisconsin Dells.

Additional details may be had by writing Professor Byron Bloomfield, Director, Environmental Design Center, University of Wisconsin, Madison, Wis.

Sanford to Head Urban America

Former North Carolina governor Terry Sanford became the third president of Urban America, Inc., at the organization's annual meeting in Detroit, Michigan in June of this year.

In an address at the Detroit meeting, Sanford called for greater assumption of responsibility for urban problems by state governments, describing the states as "the only possible points of structural leverage in promoting cooperative planning." He listed the many needs of cities—better jobs, housing, education, transportation, a generally-better environment—but cautioned that solutions to no single one "will make our cities both humane and humonly habitable."

He said the need is for "bold, multifaceted action on all these fronts at once," and urged urban experts and private citizens to tackle the planning task comprehensively.

Sanford, an attorney who maintains a private law practice in Raleigh, N.C., is also the author of "Storm Over the States," in which he described means of improving state government and the Federal system. His book, "But What About the People?", published in 1966 told the story of changes in education during his term as governor.

Governor Terry Sanford

Calendar

BRI Meetings

September 17-19—BRI Anaheim Seminars, Anaheim, California.

October 2—Half-day seminar on Energy and Lighting as Elements of Building Design, Atlanta, Georgia.

October 3-4—Fall BRI Planning Sessions and Annual Meeting, Atlanta American Motor Hotel, Atlanta, Georgia.

November 20—Follow-up to BRI meeting in Chicago, on Manufactured Building Modules, Seattle, Washington.

Other Technical Meetings

September 2-6—International Association on Water Pollution Research, International Conference, Prague.

September 7-14—International Association for Bridge and Structural Engineering, Symposium on Wearing Surfaces for Steel Bridge Decks, New York, New York.

September 7-11, National Foundation of Health, Welfare & Pension Plans, Annual Conference, San Francisco, California.

September 8-13—American Chemical Society, Atlantic City, New Jersey.

September 14-19—National Environmental Sanitation Conference and Exposition, Institute of Sanitation Management, Boston, Massachusetts.

September 17-20 — American Road Builders Association, Annual Highway Conference, Detroit, Michigan.

September 22-25—Institute for International Engineering, Colorado Springs, Colorado.

September 23-25—National Bureau of Standards, Man and His Shelter, Gaithersburg, Maryland.

September 25-26—American Institute of Architects, Annual AIA Architect-Researchers' Conference, Wisconsin Dells, Wisconsin.

September 29 - October 3 — International Bridge and Tunnel and Turnpike Association, Annual Meeting, Chicago, Illinois.

September 29 - October 4 — American Society for Testing and Materials, Fall Meeting and Materials Testing Exhibit, Atlanta, Georgia.

September 29 - October 4 — American Society of Civil Engineers, Structural Engineering Conference, Pittsburgh, Pennsylvania.

October 6-10 — Prestressed Concrete Institute, Annual Convention, Seattle, Washington.

October 7-10 — Council of Educ tional Facilities Planners, Washin ton, D. C.

October 7-16—International Counc for Building Research Studies a Documentation, Triennial Congre Ottawa, Ontario (7-11) and Washin ton, D. C. (14-16).

October 14-18—American Society Civil Engineers, Annual Meeting, Pit burgh, Pennsylvania.

October 16-18 — Hardwood Plywo Manufacturers Association, Annu Fall Meeting, Los Angeles, Californi

October17—Annual Construction I dustry Safety Conference, New Yo New York.

October 20-23—National Forest Pr ucts Association, Fall Meeting, V couver, British Columbia.

October 28-31 — Instrument Socie of America, 23rd Annual Conferen and Exhibit, New York, New York.

November 9-13 — Structural Cl Products Institute, Annual Brick dustry Convention, San Juan, Pue Rico.

November 18-22—American Water I sources Association, co-sponsored ASTM Committee D-19 on Water, N York, New York.

BRI Technical Seminars

Anaheim, California—Sept. 17-19, 1968

BRI members are invited and urged to attend any or all of six technical seminars to be held in conjunction with the Annual Building Products Show at the new Anaheim Convention Center, Anaheim, Calif. (shown above.)

The show is expected to attract some 8,000 members of the building community, including architects, engineers, contractors, manufacturers and others.

The seminar schedule provides for four sessions, each to include three concurrent seminars. Each of the six topics will be repeated once, thus allowing registrants to attend any four sessions. Topics are "A New Look at Construction Sealants," (Joseph S. Amstock, Products Research and Chemical Corp., chairman); "Roof Bonds," (Edward T. Schreiber, Construction Consultants, Inc., chairman); "Glass in Building Design and Construction," (Dr. Harold E. Simpson, State University of New York, Alfred, N.Y., chairman); "Energy and Lighting as Elements of Building Design," (Gershon Meckler, Environmental Systems Corp., chairman); "Precast and Preassembled Concrete Systems and Components," Harry L. Scoggin, architect, chairman), and "Building Design Programming," (Gerald Davis, Building Program Associates, chairman).

Seminar Registration: The registration fee for each member is $10 for BRI members; $15 for non-members. New members who join BRI at the Anaheim meeting may take advantage of the lower member-rate.

Participants may register for any number of seminar sessions, up to four. The schedule is shown at right.

Hotel Reservations: The Anaheim Visitor and Convention Bureau, 800 W. Katella Ave., Anaheim, Calif. 92802 is handling all hotel arrangements. Requests for hotel accommodations should be addressed to the Convention Bureau.

Location: The Anaheim Convention Center is located next door to Disneyland (bring the family!) just off the Santa Ana Freeway about 30 miles from downtown Los Angeles. The Convention Center and hotels are easily accessible from the Los Angeles International Airport by rental car, airport coach service, or helicopter.

Cocktails: All seminar registrants are invited to be BRI's guests at cocktails on Wednesday evening, following the afternoon seminar sessions. Admittance is by registration badge.

SEMINAR SCHEDULE: (Each seminar is repeated once.)

A. JOINT SEALANTS—EXPERIENCE AND NEW TECHNOLOGY
Sept. 18, 2:00-5:00 p.m. and Sept. 19, 9:00 a.m.-12:00.

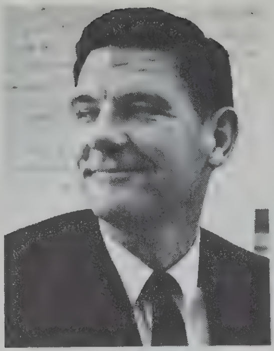
B. ROOF BONDS
Sept. 17, 3:00-5:30 p.m. and Sept. 18, 9:00 a.m.-12:00.

C. GLASS IN BUILDING DESIGN AND CONSTRUCTION
Sept. 17, 3:00-5:30 p.m. and Sept. 18, 9:00 a.m.-12:00.

D. ENERGY AND LIGHTING AS RELATED TO BUILDING DESIGN
Sept. 18, 2:00-5:00 p.m. and Sept. 19, 9:00 a.m.-12:00.

E. PRECAST AND PREASSEMBLED CONCRETE SYSTEMS AND COMPONENTS
Sept. 17, 3:00-5:30 p.m. and Sept. 18, 9:00 a.m.-12:00.

F. BUILDING DESIGN PROGRAMMING
Sept. 18, 2:00-5:00 p.m. and Sept. 19, 9:00 a.m.-12:00.



Re-Searching

by Benjamin H. Evans AIA
Executive Vice-President

Leadership and Implementation

The success of any organization is dependent to a great degree upon the leadership that comes from its governing body and particularly from the officers of that body. The Building Research Institute is fortunate in that it has been able to enlist a particularly capable and qualified group of men to assume that responsibility. Because there have been some changes in Board positions during the past year, it will be useful to review for you the current BRI Board of Directors.

Leadership also comes from the Technical Committee chairmen, Division chairmen, and the grassroots members of all the committees who serve in a variety of ways to make BRI a worthwhile enterprise.

One of the most important functions of any executive director in the implementation of Board objectives is the assembling of a group of highly competent and dedicated employees for his organization. I am extremely pleased with the people I have been able to bring together for BRI and I know you will find them cooperative, capable and eager to help BRI move forward.

Hazel Davis, Publications Sales Manager and Purchasing Agent, is Comptroller for BRI and has been with the Institute since February of 1961. Hazel received the Bachelor of Arts degree from Ohio University where she majored in English, history and education. She has also studied accounting and law at Benjamin Franklin University and typing, shorthand and bookkeeping at Strayer Business School in Washington.

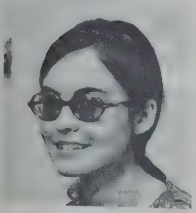
Hazel's business experience is wide and varied, including 10 years as secretary to the president of the Baker Cork and Tile Co.; another 13 years as secretary to the international secretary-treasurer of the Distillery, Rectifying and Wine Workers International Union of

America, and five years as secretary at Kersting Brown and Co., Inc. during fund-raising campaigns for Harvard and Princeton Universities. BRI is fortunate to have a person of Hazel's broad experience, intelligence and enthusiasm for hard work.

Marilyn Ludwig takes over as editor of BUILDING RESEARCH and Director of Public Relations for BRI. Marilyn comes to BRI from the AIA where she was assistant editor on the AIA JOURNAL staff and staff executive for national AIA committees on school and college architecture, hospital architecture, auditorium and theatre architecture, and the joint AIA-AHA committee on environmental health. Earlier she worked with the AIA programs on research.

Marilyn received her Bachelor of Arts degree in English and speech from Miami University where she was editor of the college literary magazine and received awards for creative writing. She was subsequently editorial assistant for Aero Digest magazine, "The Aircraft Year Book" and other publications and was with the Air Force Association as editorial assistant for the Air Force/Space Digest magazine.

We are looking to Mrs. Ludwig to strengthen BRI relations with the press and the public and to accelerate the growth and development of the Journal.



My "right-hand" is **Mical Miller** with the title of Executive Assistant who brings a youthful new exuberance to BRI headquarters. Mical has been with the AIA for the past year and a half in a secretarial position doing work related to committee activities and assisting with the Honors Award program. She received her Bachelor of Arts degree from George Washington University where she majored in Psychology. Her experience includes three months in archeological field exploration in Washington state and for a period she was research assistant at the Smithsonian working in the field of invertebrate paleontology. Besides all that, she can read and write! She is doing an excellent job of handling all headquarters communications as well as membership applications and records.

These are the people who constitute your BRI headquarters staff. The fact that they may have more than one title provides some indication of the dual responsibilities that are carried by each. In addition, we strengthen our capabilities through the purchase of a variety of business services as they are needed.

Conference Programs

One of the characteristics that distinguishes BRI from other groups in the building field is its broad-based membership which is open to people from all segments of the building industry, or building community as I prefer to call it. Almost anyone involved in design and construction activities, if he is at all concerned about the development of new technology, can find something of interest in BRI and share in the opportunity to help chart a course of action. While we have members from throughout the United States and overseas, the greatest percentage of our membership has been made up of people from the Chicago, Detroit, Pittsburgh, Washington, New York corridor. Almost all of our conferences, particularly in recent years, have been held in this area—mainly Washington, D. C. Your Board has decided that BRI should begin to extend its influence to other sections of the country and to make available to the building community across the US the research findings reported at BRI conferences.

The conferences are part of the plan for bringing BRI to all parts of the country and providing for participation in BRI activities by a lot of people who seldom get to Washington.

On October 3 in Atlanta, Georgia, BRI will hold an afternoon seminar on "Light and Energy as Elements of Building Design" for the Atlanta building community. Some 200 professionals are expected to attend. Another identical session may be held in Cleveland later in the year. Another conference on premanufactured building modules is being scheduled for Seattle, Washington for November 20 and still another for San Antonio, Texas (with international flavor) for early in December.

In Seattle in June there was a meeting of all Northwest region BRI members. It was an enthusiastic group which met and decided to undertake the "instant-space" conference. They talked also of a Greater Northwest chapter of BRI and the committee activities which could take place on the regional level. A broader (geographically speaking) based BRI is definitely in the making.

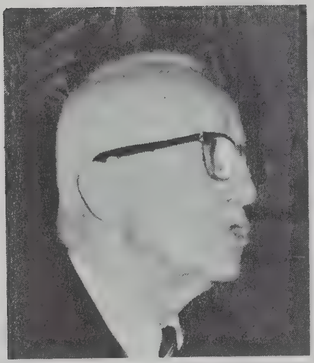
Committee Activities

In coming issues of the Journal I will describe in further detail the membership, functions, and purposes of the BRI technical committees and the standing committees. The pattern of their activities for the coming year will be redefined at the Fall planning session where all technical committee members and in fact, all BRI members, will meet. The meeting will be held on October 3 and 4 at the Atlanta American Motor Hotel, Atlanta, Ga.

At this meeting all committees will meet to formulate plans for the coming year. The annual meeting of BRI will also be held and new Board members will be elected for the new term.

The exciting thing about this planning meeting, however, is the presentation of an entirely new idea for BRI. I mentioned last month that your Board has been formulating some bold new plans. Well, this is the beginning! Within the next few weeks you will be hearing more of the details of a proposal for BRI to undertake a project of community service through which the talents and energies of BRI members will be directed towards assisting a community in solving some of its urban building problems. Come to the meeting in October. Discuss this important item and how your research and technical capability can be brought to bear on the problem. Join BRI in this exciting new program for industry and community service. You will find it rewarding and profitable. I look forward to seeing you.

Editor's Comment



Building technology, particularly during wartime, is relegated t the role of stepchild in favor of the technologies which produce ne weapon and space systems. R. Buckminster Fuller, speaking to th BRI Spring Conferences last April, discussed the state of the buildin art in a historical context which ranged from the earliest builders c fortifications, to the present moment and beyond.

Characterizing building technology as an "anti-priority," he tol his audience that the science of construction can catch up as soo as we are willing to assign to it the priorities which we now gi to the technologies of destruction.

Fuller's talk, which appears on the following pages, is a fair unusual departure for BUILDING RESEARCH. It is not a paper i the ordinary sense, since it was delivered entirely extemporaneousl To call it a "conversation," as we have done, is inaccurate, since t word ordinarily implies dialog or interchange among persons.

But conversations with Fuller are seldom ordinary. In a *Ne Yorker* profile which appeared in January, 1966, author Calv Tomkins wrote, "There is no such thing as an ordinary conversati with Fuller. One question is enough to set him talking for an ho or more, and often a question is not even necessary. His talk follo a process that the cyberneticists call 'positive feedback,' in that ea idea sets off a whole flock of related ideas in something like ge metric progression; Fuller seems never to have forgotten anythi he ever knew, and his command of statistical detail is awe-inspirin Perhaps the most amazing aspect of these monologues is that, matter how long and labyrinthine the digressions that crop along the way, he invariably returns sooner or later to the prima subject of his discourse, and everything turns out to have be relevant."

Fuller shares with a few contemporaries, like Marshall McLuh and Arthur C. Clarke, a talent for expanding the minds of his hear without acid or harmful after-effects. We hope his readers will enj the stretching process as much as did those in his audience l spring, when this conversation took place.

Illustrations for the article, including the woodcut which appe on the cover, were furnished by the Bettmann Archive.—MEL

R. Buckminster Fuller:

An Extraordinary Conversation

There has been very little fundamental change in our buildings. I think nothing could be more significant today, really, than our discovery of the fantastic lag in the building arts, in respect to all the other kinds of gains that have been made in technology—particularly in the great technology of war. We could cite the Manhattan Project, the kind of undertaking wherein two scientists, having made an actual intellectual breakthrough, then gave man great cause to take action, simply because they had proved that you could release the energy of the atom. They proved this theoretically, on paper, and at once a great nation appropriated $70 billion for the Manhattan Project, to pursue the concept of using man's greatest knowledge to destroy man. And with enough PhD's, we undertook and accomplished the deaths of quite a few people.

But there has never been any working assumption on the part of humanity that man was bound for anything other than, merely, demise. The working assumption has been all the time that there was nowhere nearly enough to go around; that life was little more than a game of musical chairs; that although life was beautiful and inspired us all with great promise, this was very ironic in light of our own experience of how rapidly life actually began to deteriorate, and how poor the chances of success really were. And we found all of humanity becoming deceptive, playing games with one another, trying to reconnoiter against those awful moments when it had to be *you* and *me*. That has been the great *raison d'etre* of all of our undertakings; and therefore, obviously, Armageddon, war, as well as all of the highest capabilities of man, have been articulated by virtue of fear. The great supreme moments, the great showdowns of Armageddon, have employed some of the highest capabilities he finds operative in nature.

There has never been any working assumption here in the building community, that it could be possible for *all* of humanity to be a success, particularly if we employed those highest capabilities of nature which we discover scientifically. It is just beginning to dawn on man that it could be so.

I find that all of the world of our building is just fraught with voodoo, and is all very secondary to the great original preoccupation with science and technology and long-distance thinking—always getting ready for the next Great War.

With all of that kind of war technology, we always have something called priorities, which have prior access to our greatest capabilities in the moments of great emergency. The Army and the Navy have been able to exercise high-priority demands on those highest capabilities, both of chemical nature and of man's intellect. And when you have priorities, you also have to have *anti*-priorities—those things which get the benefit of only what is left over. In all of our great emergencies of war, the anti-priority has always been the home front. Anything which would keep the rain off, while we were producing armaments to send to the boys at the front, would do.

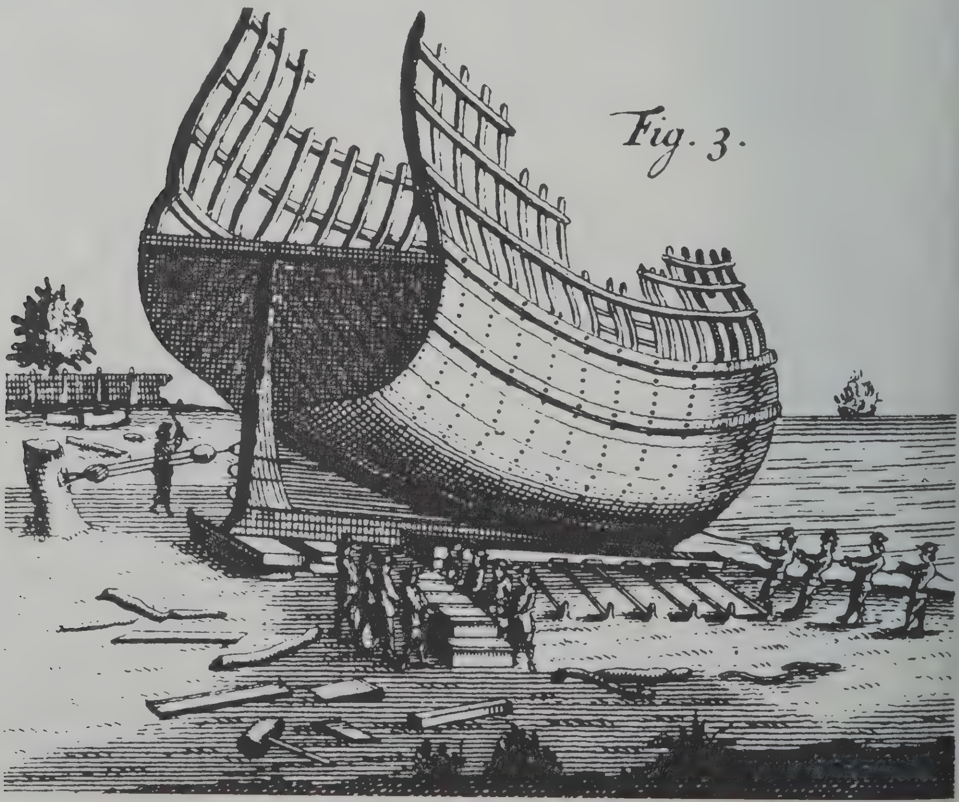
Throughout our whole history, the building arts have always been the anti-priority, the left-over time. Even when it was not wartime, and man was trying to invade the wilderness and homestead, his great preoccupation was clearing the ground, getting the seeds into the ground, allowing nature to do that mysterious thing of making the little seed grow into the great fruit or vegetable, the small animal into a large animal. Man had little knowledge of how any of this happened, but he knew that it happened, and he learned to husband it, and it became his great priority—his preoccupation.

And in clearing the stones from the field, and the trees from the field, to make room for his harvest, he had also to look out for himself from time to time. He needed to look out for his wife and his children. As they tried to settle in, their smoke arose and attracted animals and other people, and they had to guard themselves. So he took the excess stones and the wood from the trees, and built himself barricades and fortified himself, around his chimney.

Then when the harvest was in, and he had a little more time, he roofed over from his ramparts to the chimney, and that was his house. All this was arranged and arrived at fortuitously, during this secondary time—never with any preoccupation of "How do you make a scientific house?" and "How do you really protect life?"

Because man's struggles have been progressively successful, having got through his war—those who did get through the war—were so thankful to have their boys back home, and they associated their good fortune in having their loved ones return with how they had "made do" during the great privation. So here was the house in which they had "made do," and they celebrated it and loved it.

We find humanity extraordinarily preoccupied with association of the way in which, somehow or other it has survived; those who *have* survived have been able



to identify items of their survival, and find them—completely superstitiously—related to all of that building world.

Thus all of our talk of architecture relates to the very superficial matters of the great war-lord who was successful in occupying his people during wartime, and then had someone build him a castle to acclaim the great power which he had attained.

I find that all of these forms pertain to that kind of life, and really have nothing to do, today, with what we all really hope for—and that is to employ our total knowledge in such a way that we may be able to take care of everybody.

In the last two-thirds of a century, a very extraordinary set of conditions have come about. We have gone from less than 1% of humanity to 40% of humanity enjoying a higher standard of living than had been experienced or dreamed of by any monarch, before the 20th century. And during that time, humanity has been increasing its population rapidly, and the rate at which we have been able to find more reserves and more materials is much slower than the rate at which humanity in increasing. Therefore, during the period of the last two-thirds of a century, the amount of fundamental materials—the metals, mined or unmined, for each world-man—is continually decreasing. We can't possibly explain going from less than 1% to 40%—and despite the great population increase. We have actually multiplied *eighty-fold* the numbers enjoying a high standard of living during that two-thirds of a century. So, inasmuch as the materials are continually decreasing, we can't explain it as having come out of any finding of more resources, more exploitation.

There are two very fundamental ways of looking at technology: first, the high-priority technology which today we call the aerospace industry; yesterday it was the airplane, and before that it was the great weapons-carriers—the ships of the sea. Second, in contradistinction to this high-priority technology—this getting ready for Armageddon, for the next war—we have the *anti*-priority technology of building.

In a world of man's struggling to live on the dry land which he seemed to have been invented to occupy—we have only one-quarter of the earth's surface dry land, and of that quarter, only a small portion was immediately favorable to the support of life. Actual support of life has occurred on only about 5% of the surface of the earth. And that 5% was not in one increment, but divided into various tiny little increments so that we have little tiny patches of human beings, very remote from one another, around this enormous globe. Those who found favorable areas to survive did so by following the animals, which seemed to be able to test out what could be eaten, and what could not; man could also eat the flesh of the animal; and he came to a successful area and guarded it, because mankind right up until now has been extraordinarily illiterate in looking at his landscape. He didn't know which thing would kill him and which would support him, so he had to try out to see which things would support him. He was very ignorant of all the potential that existed in the landscape, and in his great ignorance, knowing very little that would really support him, he tried to monopolize that which *did* support him, and was continually invaded by those who were unsuccessful.

Those who were then successful learned to fortify their local positions, and they moved great rocks and built great walls. They harvested, and put the harvest in a granary inside the walls. They built the walls around a well, so there would be water inside. And when the enemy threatened they took everything out of the fields and put it inside the walls, and went inside themselves and locked the gates.

The people then left outside were already hungry, and there was nothing left for them, so they just gradually got weaker and weaker as they starved, and finally when they were weak enough the people inside would come outside the walls and decimate them.

This was a great scheme for security, for man on the land. The bigger and higher and stronger the wall, the bigger the granary, the bigger the bank account, the more security was felt. Security was with "bigger." And all of our building has been along those lines—all of our thinking about building has been just exactly that. Whoever had the highest walls and the biggest granaries had the best chance of surviving.

In 1929, I was asked to demonstrate my Dymaxion House before the American Institute of Architects' annual convention in Washington. I asked all the architects if they would tell me what the convention hotel weighed—just roughly, within 100,000 tons—and there were no hands.

I have been asking architectural societies around the world that question ever since, and I have never found an architectural society anywhere in the world where anyone knew how much the building it was meeting in might weigh, within a million tons. What buildings weigh has not been in the language of buildings. And if you don't know what your building weighs, you can't think in terms of performance per pound. You can't have such a ratio if you don't know the weight. Therefore I can only assume that all the building man has done has been based on the theory that the more weight you have, the more security—he didn't care how much more. The approach is still oriented toward "bigness."

Now in contradistinction to that way of approaching problems, we have three-quarters of the earth covered with water. There were men who learned how to venture out onto that sea, first after just the local fish, then discovering that resources occurred in remote lands which were not known at home, which if brought home and combined with what *was* at home, would bring about very great advantages to the people back home. Therefore there were men who learned how to voyage and to seek for the great, unevenly-distributed resources around the earth, and were thus able to realize vast wealth. A single voyage could make a great fortune.

These men then learned, gradually, through evolution and their dealing with the sea, to produce bigger and bigger ships, until finally they developed very deep-hulled ships which could carry armaments and could make it possible for them to fight for their position on the sea. They had to fight, because no sooner had one man succeeded in bringing home this great fortune, than this excited another man, who said, "I'm not sure where he's gone, but I know he'll come back to this harbor—so I'll build a smaller boat, and man it with some very tough boys, and the night before he comes in, we'll take him over." Thus piracy came about.

We had a handful of human beings who learned about mathematics, and invented navigation, and learned how to get around in open waters where there is nothing but the stars to guide you, beyond the sight of land. They learned by experience how to design ships that would really take the great seas in times of hurricanes. They were great designers, and they were also very powerful men with the sword, in order to be able to command enough men locally to invest the time to build that ship; to have those people all fed while they were building the ship; they had to have extraordinary mental capabilities in order to understand their navigation, and be powerful enough to keep their secrets to themselves, and not let the other man know when and where it was that they were going.

These men who finally did succeed in going to sea developed an entirely new kind of technology; for the first thing about going to sea is, that your ship must stay on top of the ocean. That is very different from the building on the land, where you have no concept of its floating. Today, engineering-wise, we know that buildings really *do* float, but men did not realize that at the time. They did not realize, as we do, that when we plan a building on Manhattan Island, and we drill to get the proper footings, that we inadvertently pull out about the approximate same weight of rock as the building that is going to be superimposed—that there is actually a floating that goes on, a displacement, even though it's rock. That was not thought of then in terms of building on land, but it had to be taken into account with ships and the sea—you have to stay on top of water. You have flood all the time; you have hurricanes every other day. When you have great waves, you have quakes which are much greater than earthquakes on the land. Men going to sea had to deal with forces and patterns of force vastly more powerful than and they had ever had to cope with on land—so that designing the ship to stay on top of the water involved being able to cope with these great stresses, and to do so always within the cubage, the weight of the water that is displaced by the ship itself. That is the only way it could possibly float.

So the men who went to sea, and who found themselves then competing with other great pilots for the great sea-lanes, to see who was going to master the wealth of the earth, found themselves in the following position: We have a ship of a given size—let's say that we have found it to be the optimum size for that kind of cruising. I've built my ship locally, but we then go to the next country, where we have learned that they have much bigger and more powerful trees; therefore we can put in a much stronger mast. We come to a country such as the Philippines, where there are much stronger fibers, and we put better fiber into our ropes. From other countries we obtain better fabric for sails. So as they went around the world, they kept increasing the *performance per pound*. Thus, granted that your ship and the other man's ship have equal displacement—equal tonnage—if you had better equipment, you could weather the hurricane and he could not; you could out-maneuver him in the great battle to see who was going to the bottom, and the man who did not have the high-performance equipment went to the bottom. The struggle at sea was one of continually *doing more with less*—more with three fundamentals of resource: the amount of time you have to get the sails on and off; which related to the number of men in the crew and the muscle or energy in the arms of those men; and the weight of the material which they must handle. The very essence of the gradual mastery of the great sea-lanes, and thus of the resources of the earth, was all dependent on the great secret of designing ships: How do you do more with less?

Because it was the very essence, it was kept secret; the men involved with the design weren't even allowed to look at total designs; only the very top men realized that *doing more with less* was the very key.

We don't have in any books on economics, anywhere in the world today, one chapter on doing more with less. It has been the most secret of all technologies—something that is only just coming into the open today.

Out of that technology of doing more with less at sea, came the development of the airplane, when it was realized that instead of just covering three-quarters of the earth on water, you could cover 100% with the ship of the sky. And the displacement ship would not do; the balloon was too easy to shoot down and too hard to control, so you had to have the wing-foil ship that could maneuver rapidly. In order for that wing-foil ship to stay in the sky, it had to be pulled through the air at enormous speed, which meant very heavy engines and very heavy fuel, and also a very powerful structure, because you just *start* flying at hurricane speed—you *start* with the very worst kind of conditions. And approximately sixty years ago—that same two-thirds of a century I've been talking about—we had that little airplane and one man going a few feet in a very few seconds—all he could possibly stay in the sky.

The doing-more-with-less in that two-thirds of a century, brought about by the great nations of the earth spending over two-and-a-half trillions of dollars on developing the airplane, is a great reference-carrier. During the two-thirds of a century we have done so much more with less as to bring about a completely new technology. And today we have on the boards a ship which will carry 10,000 passengers halfway around the world in a few hours.

Doing more with less is superbly illustrated by the fact that there is one communications satellite in orbit today, weighing one-quarter of a ton, which is outperforming the transoceanic capability of 175,000 tons of copper cable! It is only out of that "more-with-lessing" that we have had all the fallout from the primarily-military preoccupation of science. As the great contractors find their particular contract with the government running out, because a new device has supplanted them and they have been made obsolete, they then look around in the domestic economy for some outlet for their capability.

Therefore I must say to you that the great, the surprising numbers who are being taken care of by technology today, are benefiting from pure fallout from the preoccupation of science, on a fear-basis, with Armageddon—always with the idea that there isn't going to be enough to go around. So for all the wrong reasons, we have been doing the right things.

I am sure that this "doing more with less" is going to have to be employed by man in a very comprehensive way from now on, or we're not going to stay on the face of the earth much longer. At the present, all of the metals that have been mined and put to work—and remember that they are decreasing per world-man all the time—are invested in structures and machinery which, operating at full capacity, can only take care of 44% of humanity. That is the design level that we now employ; that is its full capacity. This means, then, that 56% of humanity is doomed to non-participation in the high standard of living of industrialization, and is doomed to go on dying at an average age of 27. This has been the great historical picture—less than one-third of his full life-span realized, and that spent in great privation and disease and pain. Thus the great majority of our populations are still have-nots; and the essence of all of our warring has been that the have-nots have everything to win and nothing to lose. So we have, imminently, the great revolution of the "outs" against the "ins"—the idea of the have-nots that there isn't enough of anything to go around, and that they must kill the haves in order to be able to survive themselves. This is the great pressure around the world.

There is, however, nothing that can be done politi-ally to solve that problem by virtue of employing any-hing that we are familiar with in the way of design. The best design level we are now exploiting can take are of only 44% of humanity.

It is perfectly clear as we study technology that the ind of "doing-more-with-less" that is already operative n our electronics world, would enable us to produce nough to take care of everybody. For the first time n the history of man, science now says "Yes, it is true; e are enough the masters of energy to handle the ncome-energies on board our spaceship, earth, in such a way as to be able to regenerate all of the life of all humanity." But scientists all say that this cannot be done with our sovereign boundaries. You cannot do it so long as you prevent resources from flowing freely from here to there. Because in order to be able to do *totally* more than less, you have to employ 91 of the 92 regenerative chemical elements that have already been found on earth; because doing more with less is always accomplished by finding those unique capabilities inherent in nature—that beryllium springs, for instance, do not fatigue, do not spark, and so forth. Beryllium has its own unique capabilities. We must be able to have each of those *right* metals for each of our functions.

In order to have just one telephone instrument, we have to go to five continents around the earth—and that is in spite of sovereign boundaries and their frustrations, just to have that one little capability. So the scientists make it perfectly clear that we cannot have our sovereign boundaries.

And all of us are world-conditioned to the point where our sovereignties are claimed by men who are utterly illiterate—just the strongest man with the largest sword—the cleverest men, capable of decimating the most men, can claim the most deer to eat. This is our sovereignty. We have no working basis in our world except "not enough to go around" and a lot of illiterate claims to sovereignty, frustrating all of our fundamental realizations. I say that our task of research—research in building, research in structuring—is a very, very great one; it mustn't be confined just to learning to do the most with the least, structurally. It must involve all of our thinking. It involves the literacy of all of humanity, regardless of what the problems really are, trying to see things in these biggest ways.

In all of structuring, we have always and only, coexisting, tension and compression. And in all the history of tension and compression complementing one another to give us buildings, some kind of environmental control, we have a history of the great superiority of stone in compression, in contrast to the tensile capability of that same stone, which is rather poor—around 50,000 pounds per square inch of compressive strength, with a tensile strength of only about 50 pounds. Throughout all the great ages of compressive advantage, we have had available something stronger in tension than stone only in wood fibers. Our best wood fibers went only up to about 5,000 psi in tension—around one-tenth the capability of stone in compression. Also, wood fibers rotted very rapidly, and burned, and stone did not—so it was not surprising, in view of the compressive capability, that man built stone on stone. Of course, he could not take care of the horizontal problems of spans with his stone, because it didn't have enough tensile strength. So he had very short stone lintels, and no real stone beams. Therefore, he used wood beams. The wooden beams did rot out and burn out, so that we find in all our antiquities those vertical compression walls of stone, and the tension-power all burnt out. We have, gradually, man's discovering of metals existing in that landscape, in that rock, and his gradual ability to separate metals out from it. But it was done in a very meager way throughout the 2 million-year span of man's history, and only enough for little tools, like daggers, and jewelry. In 1851—just over a century ago—we got into our first production steel. And with production steel, which was developed entirely for the great pirates to build their battleships, and they used that steel in the ships for 50 years before anybody thought of putting pieces of steel into a building on the land—steel's going into production brought about an entirely new capability. Suddenly we had a mild steel which had an approximate ultimate capability of 50,000 psi in tension. So one century ago, man brought his tensile capability into parity with his compressive capability. And tension is the very essence. For a building to cohere—like the bands in a barrel—for a building to hold things together is in the tension.

It is not surprising to find an Abraham Lincoln, at that moment, discussing the possibility of right coming into ascendancy over might—thinking then of the tension as intellectual ability—the use of our brains to hold things together, in contrast to our compressive capability of war, of bearing down, of illiteracy—of the hammer, and the sword.

We have from this point on an acceleration in the tension capability. We have Roebling taking piano strings and developing enough of them in production to develop his great Brooklyn Bridge. World War I saw the development of aircraft steel, with 120,000 psi tensile strength, Roebling having gotten up to 70,000—our compressive strength is not increasing here. We just simply stay at our stone compressive capability of around 50,000 pounds. In between the first and second World Wars, we developed chrome nickel steel which got to be used in a big way with the beginning of jet engines, and we got to 350,000 psi tensile strength. Since World War II we have come up in the laboratories with a whole series of very high tensile capabilities, in glass, beryllium, iron and sapphire crystals and aluminum, we have gotten up to 1 million psi; more recently, with boron, we have broken through to 5 million. Fantastic gains, then, in tension, just in the very last seconds of man's history—and all this "doing more with less" structurally is all related to this increase in tensile capability. That is going to have to be met with compressive capability—nature is always balancing things.

You find a beautiful tree standing up there doing tasks that no engineer has ever really been able to compete with, because nature does not use her crystalline material in anything but tension. She does her compression with hydraulics.

The tree is just full of water. The noncompressibility of the liquid and the distribution of the loads through the fluidity give extraordinary strength, so that while the tree is crystalline in tension, all the compression is done by hydraulics which are noncompressible. Then between the molecules of the liquids are little molecules of gas, which are highly compressible, so that the flexibility of that great tree with branches weighing five or 10 tons swinging around in the wind—the flexi-

bility is all achieved with the compressibility of the gas in between the noncompressibility of the liquid components.

We began to use this kind of hydraulic compression in the earliest of our great buildings in New York, with the hydraulic elevators. We had 20 or 30 stories, with a very small shaft, 18 inches, shoved in a hole in the ground, full of water. Because the liquid was carrying all of the compression, the metal was thrown into pure tension, so we got into column-ratios with the hydraulic columns that have never been matched in any structural members made by man. We tend to think in terms of 20 to 30 diameters high in a steel column, but in the hydraulic one we got into several hundreds of diameters high.

We are coming into a new era where we are going to begin to balance these new, very high tensile capabilities of millions of pounds per square inch with hydraulics—we are coming into a very new period of hydraulic compression. This is going to call for a most exquisite technology. When you get into those kinds of tensions and pressures, you must have an exquisite metallurgy. This is the kind of technology that cannot be even thought of in the building industry—that left-over industry of just doing whatever you can with whatever is left over, and nobody even knowing what it weighs!

Things are going to happen very rapidly as we come to realize that there *is* enough to go around, and science becomes preoccupied with looking out for all of humanity, and we give up the idea of Armageddon. This, of course, we will be more or less forced to do, in terms of the world political situation. If we do give up wars and preoccupy ourselves with ways of really making man a success, our very advanced aerospace technology will be applied to things at home. I would like to give you a little idea of the kinds of things that can happen.

I was talking to the Lockheed Company three years ago, and they already had on the boards this 10,000-passenger ship. And they found that as you double the dimensions of a structure—you can think of it as a clipper ship or as whatever piece of geometry you want—as you double the length, for instance, you increase the surface by four. The linear is now two, and the surface is two to the second power, or four—but the volume is two to the third power, or eight. So when you double the size of the ship, the friction which relates to its movement through the air is actually cut way down, in relation to the much-larger payload. The great limitation on the airplane has been the length of the runways to accommodate those big kinds of ships. But vertical takeoff is now advanced, so that Lockheed preparations for this ship is one which assumes VERTOL takeoffs and no prepared fields whatsoever. Therefore, they pointed out, we are now at a point where we can produce in a factory, under completely-controlled conditions, this 10,000-passenger ship—something along the dimensions of the Empire State Building. Therefore we can mass-produce, under factory conditions, highly automated, a large building; make VERTOL delivery; up-end and deliver your building! My curve of acceleration shows that within 15 years you should be able to expect full delivery of a full city, anywhere, any day. Just as you can bring a great fleet of ships into any harbor, we will be able to move our cities around the earth to accommodate our traffic in every kind of way. And it is only the kind of very advanced aerospace technology that will be able to handle those very high hydraulic pressures I mentioned earlier. This is not going to evolve out of our present building industry at all. It has nothing to do with present labor problems in construction; nothing to do with present building codes, but it is very imminent.

I once devised a chart which is 800 years long. It starts with the year 1200 A.D. and goes to 2000 A.D. I was looking for a fundamental background of all of science and technology—of all the great accelerations. We tried a list of all the inventions made by man. It's wide open; we can always find another invention, another discovery. But there is a closed system of nature, and that is the 92 regenerative chemical elements. Man's isolation of those 92 regenerative elements represents a closed family of energy-agents.

In 1200 A.D., man knew of and was dealing with carbon, lead, tin, mercury, silver, copper, sulfur, gold and iron. Those were known prehistorically. But in 1200 A.D., we made the first known isolation of a chemical element by a human being. That was arsenic. Then there was a 200-year lag until the next isolation, which was antimony. Another 200, and we come to phosphorous. Seventy-five years, and then zoom—up we go, averaging one every two years!

This is greatly accelerated by the scientists who have become preoccupied with the gases, oxygen, hydrogen, etc. That curve shows some "shoulders"—it slows down.

Those slowdowns are great wars. Science is often said to prosper during war. It's not so; during war, what science found out yesterday is applied as technology.

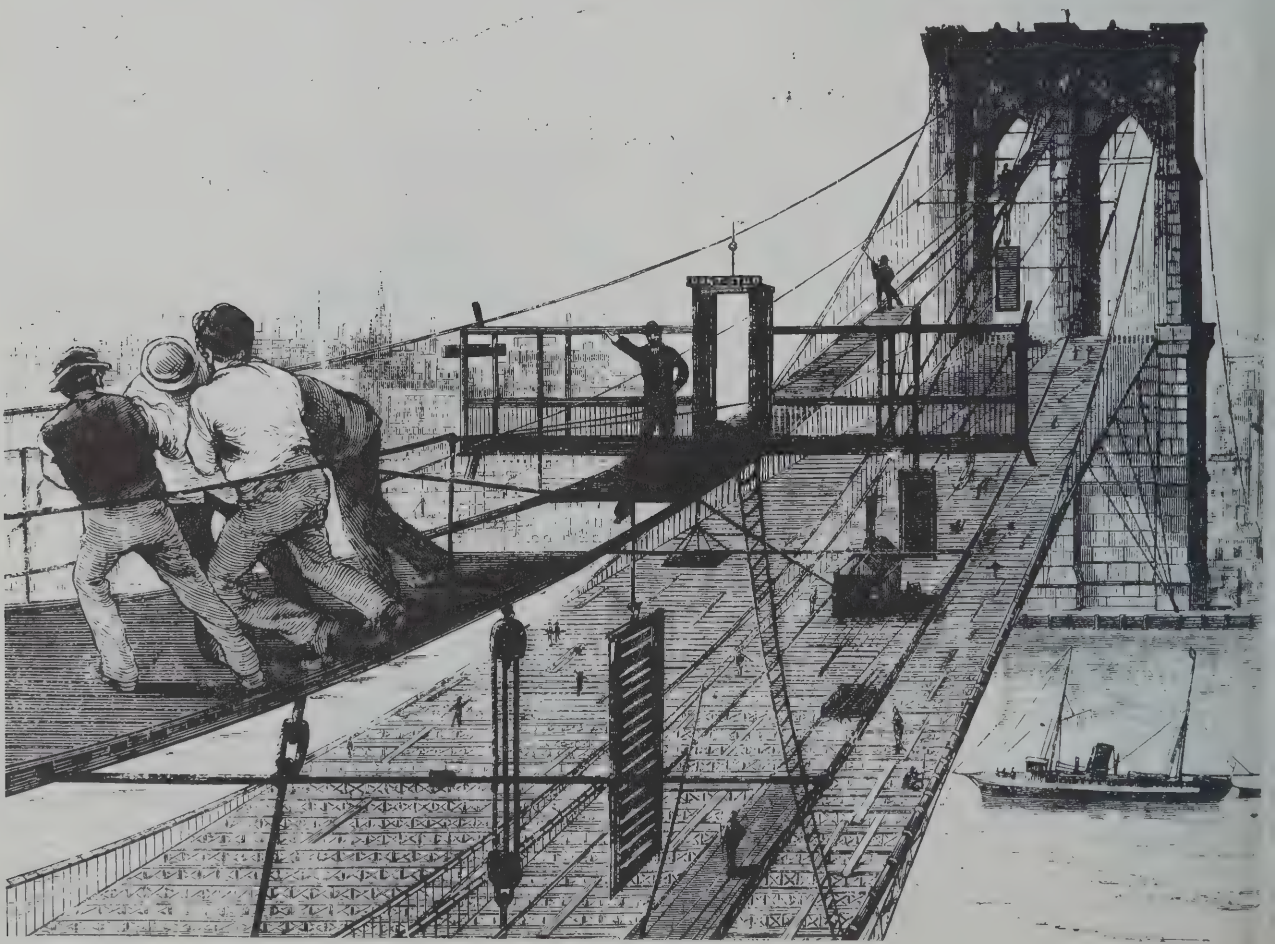
This chart, then, was a profile of man's acquiring of fundamental controls over the basic structuring of nature. Because men do not build buildings out of materials. Men build visible module structures out of invisible module structures. It's all structure, and these are all the chemistries by virtue of which we have the various preferred associabilities that give us higher and higher performance per pound. We have been able to take the chemical universe apart and find the behaviors of each, and find their associate behaviors, and bring them together in complex ways. It is those complex behaviors as they come together that are doing the "more-with-less" at a fantastic degree.

On my curve, there is a real slowdown. That is 1932, the Great Depression. And yet in that year 1932, the 92nd isolation of a chemical element occurred. That is the year, although it's called the Great Depression, that shelves were filled for the first time with the basic ingredients—man's control over taking his chemical world apart—and the ingredients were reassociating those elements in preferred ways to get better performance-per-pound, to take care of all of humanity.

From this point on, we have the post-uranium elements coming in with great regularity. Against this great backdrop of all of man's subjective findings—and scientists don't know what humanity is going to do with their findings, the scientist acting merely as an egg-layer who doesn't know what society is going to do with his egg—we have, then, all these subjective findings, and we have the great challenge of humanity to deal with the environment.

We hear the word environment used a great deal nowadays, and I am going to give you my definition. *Environment* is everything that isn't *me*. Everything that isn't *me* is all the rest of the universe, and in all kinds of patterns with which we have to cope. And man's dealing with environment becomes a very impressive affair as he has gradually learned through those technical capabilities—those increasing tension capabilities, etc.—to handle a little more environment.

Against this backdrop of 800 years of the chemical elements, I want to examine fundamental victories of man in becoming master of larger amounts of the environment. So I give him the task of developing an environment inside which he will be able to penetrate a part of the universe which he has not been able to penetrate before. As he has a controlled environment, within a noncontrolled environment, he is able to go into the noncontrolled area with a new kind of capability. I give him a standard task of getting and developing an environment-control which makes it possible for him to live under conditions that would previously have been lethal to him, and being able to circumnavigate the earth inside that controlled environment, while controlling the energies outside the controlled environment which will get him from here to there—something over and above his own muscles.



I have his first circumnavigation of the globe in a wooden sailing ship. He is controlling the energies of nature in the winds which propel him around the earth, with just a tiny little muscle to operate the sails.

Three hundred and fifty years later, he goes around the world in a steel steamship. Seventy-five years later he goes around in an aluminum airplane. And 30 years later, he goes around in an exotic metal capsule, powered by rockets. The first took him two years; the second, two months. The airplane took two days, net, and the rocket a little over an hour.

Notice the contraction of the periods of time between these milestones. Given this type of acceleration, and talking of 1975, it is not ridiculous to say, literally, "Anything can happen." It might not be ridiculous to talk of sending you around the world by radio.

We are so accustomed, in the building industry, to long periods of time when there is no change, that I want to help you realize that things *are* happening, and happening very rapidly. The most important thing to realize is that 99.9% of all the research that is going on, that is going to change our tomorrow, is going on in the areas of the electromagnetic spectrum, the utterly invisible demesne.

If there is anything very permanent about our building world, it is that we have stuck to our senses—to things that we can see, and hear, and smell, and push—and so we think about this very superficial architecture, whereas the whole big task here is going to be making society successful in its *total* environment. Thus we might see a man walking around, and you can't see what is controlling him, and he doesn't need any more armor, nor even a house any more; the rain simply diverts from him. All these things are coming. Invisible architecture is coming, and coming very rapidly.

At the University of Michigan, 15 years ago, I made an experiment with a centrifuging building. We had a revolving door made out of very thin metal slats. It revolved so rapidly, like an airplane propeller, that you couldn't see any of the slats. We took buckets of rice, because we didn't want to get water all over the place, and learned that you could not get anything to go through this invisible door. And we found that it was possible to control the slats so that they would pull the air in or out of the building, so that the invisible door was conserving energies, and doing anything you wanted. That was 15 years ago. I find it very practical now to talk about larger applications.

I myself have been experimenting with how to do more with less in building, over the years; to try to find for myself some of the significance that would attach to doing more with less. Structures such as the Dymaxion House and the geodesic dome have all been experiments in how to do more with less.

And I will tell you that the Expo Dome at Montreal is the first world's fair building we have had, where we know what that building weighs! It weighs 800 tons, and I'm sorry; it weighs 800 tons because our government said it couldn't afford aluminum, which seemed to me very preposterous.

The dome at Montreal could house Santa Sophia; or it could take St. Peter's, or the great cathedral at Seville. And it weighs only one three-hundredth as much, per unit of enclosed space, as those buildings. One earthquake which would shake them right down would not bother that building; it's designed to be fully earthquake-proof.

I now have over 5,000 structures that have gone up around the world, many of them delivered by air, very economically; it's the logical way to deliver them. When we learn to do this on a world-scale, the ratio of going from taking care of 40% of humanity to 100% becomes very clearly feasible. In the world of research, and building, we have by far the most exciting possibility of man's conquering his great woe of all the period before; where we start saying, "Man is designed to be a success."

I would also like to caution you. As we get into better-advanced technologies where they move faster men behave better. They don't behave very well with automobiles, and they kill a great many of each other with them. But when we got into the airplane, which scared people very much because they could understand how quickly they could die if that thing fell out of the sky, they behaved very much better.

You meet a young man who is a pilot-instructor, and no man was ever more faithful to his fellow-man than that individual. He is just not going to misinform the student in any way that is going to put his life into jeopardy. And the mechanic working on an airplane, certifying that he has done his work, is as reliable as any surgeon. This same pilot or mechanic may go downtown to a barroom and misbehave very badly. Thus the greater acceleration, the better we behave.

The airplane did accomplish flying over the ocean with relatively few people falling into the ocean. But it is very extraordinary when you think of all we have accomplished in aeronautical/space technology. We have gone out beyond all of the kinds of life-support we've known before, to have human beings orbiting the earth, millions and millions of miles out, without the loss of a single life in space. This is where man has done his best research, and we have all of humanity really looking at that little man in space. When man goes off into space, we should make him a success; take care of his regenerative processes, do all sorts of things we have never done before. In the space program, for the first time in history, science is preoccupied with making life a success. As our first moon-capsule goes off, in which men will stay for days—not just a few orbits—they will actually be using the regenerative processes of all their liquids and chemistries. Very little needs to be added in the natural process.

Thus, if we can make man a success anywhere in the universe, we can make him a success on the earth. So I urge you all to do anything you can to foster our space program—for only in space is man's integrity high. Our integrity is low in the building industry!

ARCHITECT DEVELOPER MANUFACTURER GOVERNMENT USER and the Office Building

Historically, the office complex has pioneered both technological and design aspects of the building industry. It has been the realization of man's ability to build to great heights and contain great numbers of people. At the same time, the office building has been a design innovator—a symbol of its time.

In the past two decades, the image of the office building has been altered by a new determinant—expendability. Quality and design have ceased to be intrinsic and are instead sought in terms of dollars returned. We are not interested only in building well; we are compelled to build as well as possible, and rapidly and cheaply. The results have been discouraging at times.

Two sessions at the BRI 1968 Spring Conferences were spent in examining the services available for creation of office buildings. These services exist not in the spirit of cooperation, but often in the spirit of competition. New information is too often used to gain a bargaining advantage, rather than as common knowledge to benefit the result.

Each of the individuals and firms involved is likely to take a different approach, and each approach may have particular advantages. Spring conference participants examined the various approaches in an effort to determine how the product—the office building—might benefit from a cooperative effort.

A group of papers from the conference are published in the following pages.

World Trade Center
New York, N.Y.
Minoru Yamasaki and Associates, Architects

MANUFACTURER
DEVELOPER
ARCHITECT
GOVERNMENT
USER

and the Office Building

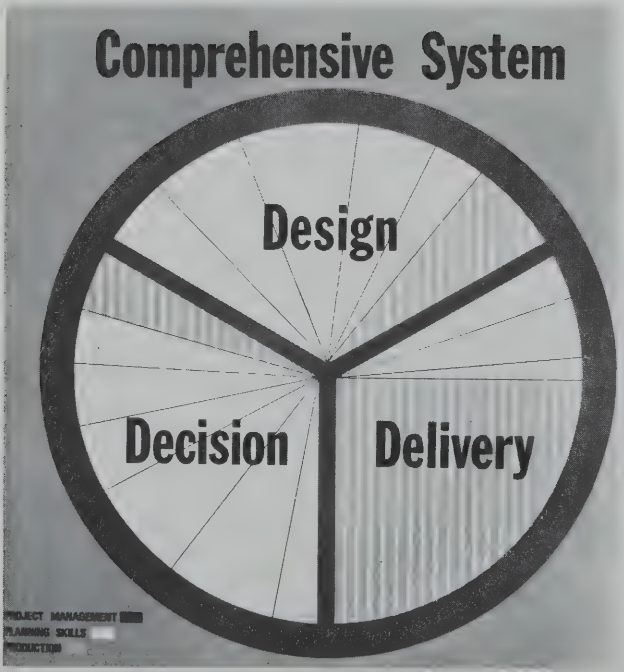
by James R. Livingston AIA

Let me preface my remarks this morning with the confession that after some 20 years of practice in the field of architecture, I'm not at all sure what an architect is. This confession comes without a great deal of apology. In retrospect, the architect's role has been under the forces of change over the same period. Historically, the office building process was quite simple—with only three principal parties performing the major roles in the creative process. These parties were the owner-user, the architect and the contractor.

Each of the parties in this triumvirate, of course, had secondary support. The owner-user has had financial and real-estate support. The architect has been supported by the engineering professions and the supply industry. The contractor has been supported by subcontractors and suppliers. The traditional process was a sequential routine, linear in nature, with the owner-user making virtually all of the pre-design decisions, and then selecting the architect; the architect devoting most of his energies to the design function; and finally, the selection of the contractor whose exclusive role was delivery of the building as designed.

What has happened to this traditional process over the past two or three decades? First of all, there are the visible signs of change. We have seen emerge a wide variety of combinations of principals in the office project—all assuming a prime role. The owner-user is often a collective entity. Frequently the owner-user is not even in the picture when an investor or entrepreneur takes on the role of owner while the project is being designed and built. The design-and-build organization has emerged as a major element in the process. Recently large corporations, including supply organizations, have entered the field by putting capital into the projects. And government is a continuously-increasing influence through taxation policies and subsidies. Today there is a required array of environmental, behavioral, and process specialists. We need the planner, economist and the sociologist. Like other segments of our economy, we are caught in a process of change—accelerating change.

The architectural profession and The American Institute of Architects in particular, through its Committee



on the Future of the Profession, has been studying the problem. The Committee has produced a new concept of the creative process for man-made environments, embracing all of the functions which take place from the initial decision making through design to final delivery. The three D's—Decision, Design and Delivery are the total process of creating the office structure. Architects traditionally have had the D in the middle—Design. The question is, should we expand our capabilities beyond design in order to play a more vital role in the future.

Time will add new members to the creative team. Demands will increase for a better office environment and better performance. The number of interfaces occurring has increased and will continue to increase. Decision will overlap design; design will mingle with delivery. New construction techniques have become significant design tools for the architect. This will continue. It is all part of a constant search for faster and more economical construction methods.

Precast—lift slab—water-cooled steel—welding—slipform—cranes that creep and climb and telescope, and even the helicopter—all become tremendous creative inputs in design. The decision model for the total process will become much more detailed and complicated. To avoid chaos the process must have a complete decision plan using systems management techniques.

There will be a big demand for management talent in the integration of the three D's. Another principal is rapidly being involved in the process. Some clients are presently going to management-type organizations for project management services. The client wants a responsible executive to manage his design and construction efforts. The demand for project management will continue to grow. Its success lies in effective and modern management techniques over time, cost and quality from start to finish.

The traditional architect has two choices: He can augment his practice with project management services, or he can work for the project management team.

There will be a big demand for management talent in the integration of the three D's. I believe the architectural profession is the logical choice to fill this management need. The architect of the future will be a team with diversified talents and with more management skills than at present. A single architect would have to be a superman to provide both the management and design skill required of today's complex projects.

Why should a profession which has traditionally concerned itself with design be a natural choice to fill a management or decision making role?

First of all, architectural design is primarily a decision-making process. Design has structure. Design problems have these important decision problem characteristics:

1. The setting of an objective or goal definition.
2. The determination of alternate means or options for meeting the objective.
3. The determination of criteria with which to evaluate each alternative.
4. Selection of the superior alternative.
5. The computer's enormous potential for complex problem analysis.

The second reason our profession is the logical choice to pull the three D's together, is that increasing numbers of architectural firms are acquiring a computer capability. Our own computer was installed late in 1966 and we made this decision for the following major reasons:

1. The urgent need to shorten design schedules on large scale projects.
2. The desire to do a better job.
3. Conservation of scarce talent.
4. The need for more complete and up-to-date project management data.
5. The major uses of our computer at the present time are in the areas of design, management, and accounting.

In the design area, functions performed by the computer are: specifications, heat loss-heat gain, duct design, short-circuit analysis, lighting design, elevator service, and a wide range of structural programs.

In the recent design of the 28-story Federal Office Building in Detroit, we used the computer to analyze the shear wall and temperature effect in about two hours. Without the computer, 350 hours would have been required. We are also using the computer in connection with CPM programs.

Our office is convinced that we have only begun to utilize the computer's enormous capacity for complex problem analysis. We are developing a program for an economic feasibility study for commercial buildings and a probability analysis of design alternatives during the initial planning phase.

Third, some very encouraging things are happening in architectural education. The architectural student is learning the potential of the computer. Some schools are moving in the direction of a degree not only in design but an architectural degree in the environmental disciplines. We can condense the time required to teach the design of buildings and spend the remaining time to specializations such as management. I believe it is essential that we identify management as a degree in architectural education. Both the schools and the profession must work hard to continue to develop a whole new approach to education.

It is only through imagination, the development of competence, and a dedication for leadership that the architect will deserve to be the leader of the total creative three-D process. He will recognize need and be skilled in analyzing feasibility and handling problem solving through systems approaches. Management leadership is earned—not conferred.

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ARCHITECT
MANUFACTURER
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and the Office Building

by **Peter E. Pattison**

Architecture and building express something special about people—their lives and aspirations. This shaping and massing of space says something words cannot always express.

Today we study ancient Greece by viewing the Agora. There is no better way to understand 12th century France than to visit the great architectural expressions of that time—the Gothic cathedrals. But buildings are not just history books. They are everyday environment, and as such, visual and functional demands are constantly placed upon them. Architecture and the resulting buildings must relate to the needs of the society they serve.

We have heard it suggested that (1) the results of office buildings in the past 20 years have been discouraging, and (2) this has been a result primarily of an emphasis on return on invested capital instead of on quality and design.

I would like to discuss these two points in relation to the requirements placed upon any building to serve the demands of society. These demands are numerous and varied but generally they may be classified as (1) functional requirements, (2) public financial contribution, and (3) visual and esthetic considerations.

In my opinion, the great surge in office construction in the past 20 years has been largely successful in meeting the demands of the first two points. American business has undergone a radical change in this period which has completely changed the concept of office structure. Flexibility and rapid expansion have become the prime functional requirements of office tenants. Developers, architects and space planners have met this requirement by standardization of office design which has allowed office interiors to change quickly at minimum cost. This flexibility has been one of the prime reasons for office building demand during this period. Likewise, the construction of office buildings has made a major contribution to municipal financing and city employment. Taxes on new office structures have been one of New York City's principal sources of new revenue. In addition, the large increase in office jobs has filled the void in our cities which was created when manufacturers left the downtown area. In New York, 500,000 industrial jobs have left since World War II. This slack has been largely taken up by new white collar jobs in office buildings. It is no wonder that most municipal officials have encouraged office construction, sometimes ignoring the strong criticism of city planners and design consultants.

The office building in the last 20 years, therefore, has in many ways been highly successful and no analysis of esthetic and visual qualities of office structures is valid without considering these other benefits.

The other assumption which has been made is that the basic problems of quality and design of office building stem from an over-emphasis on return for invested capital. This assumption is the result, in my opinion, of a lack of understanding of investment capital. Investment capital, like every other commodity, is limited and fluid. There is not a set amount of money that is available for real-estate development each year. All real-estate ventures must compete on the open money market for available funds with other investment opportunities, such as stocks and bonds and equity investments. Real-estate entrepreneurs, therefore, must seek the highest return possible to compete for available funds. These conflicting demands and the search for management profit create the dynamic environment within which all real-estate developers must work.

I have been asked to discuss the initiation and control of an office building project. What do we look for in a real-estate investment, and, once a project has been committed, what framework or procedure do we establish to carry the project through to completion?

Analyzing the Variables

In recognizing good office building investment opportunities, the first requirement is to bring together a mass of information and experience into some logical framework for analysis. When a potential location is considered, one must be fully familiar with the surrounding area and the potential office-space market. This requires consideration of a multitude of factors such as transportation, labor supply, existing office development, nuisances, etc. One must also analyze the physical characteristics of any potential site—size, shape and subsurface conditions. Zoning, existing site improvements and possession are also considered. If any of these factors are detrimental, it is possible to modify or improve the situation—for example, by increasing the plot or getting a zoning variance? Economic factors must also be considered. What is the estimated rental range for the location? What is the tax rate and how will the property be assessed? What are the operating costs? The investor then figures the risk and the necessary contribution of his expertise to set a minimum return for his participation. It is only at this point that the investment builder can start to think about design. How important is design and how will it affect any of the other factors outlined above? Many developers do all of the aforementioned analysis quickly and intuitively, but ultimately, all of this material has to be mulled over and checked very carefully.

A specific example might clarify this process.

About two years ago, we became aware of several land assemblages in downtown New York near the foot of Wall Street at the East River. The particular parcels brought to our attention were two sites of approximately 22,000 sq ft each separated by a small road. In the neighborhood there was a recently-completed office building on a similar site. Renting had been slow, mostly to small tenants. Under New York City zoning, the potential FAR (Floor Area Ratio) for each of these sites was approximately 400,000 sq ft. The lower floors could cover about 80% of the site and the remaining FAR allowed would be in a tower with floors of 8,800 sq ft each. To take advantage of the maximum FAR, the building would have to be at least 38 stories high.

Tenants in downtown New York are very status-conscious. Good tenants will pay high rentals for what they want, and in New York, tenants want location. These sites, however, were not located in an established district—therefore, tenants would not only be small but they would be located away from the heart of the dis-

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trict to get low rentals. But low rentals in a 38-story office building in New York are not possible, because of the economics of building. Accordingly, neither proposed site could be considered an attractive investment.

At this time, however, brokers had made us increasingly aware of the developing demand for large floors near the financial district. These large floors were required because automation and computers were revolutionizing the handling of paper—checks, stock certificates, bills, etc. This space had to be located near the source of the paper—the downtown area, with its banks, exchanges and large insurance companies. We also knew the city of New York hoped to revitalize major parts of the downtown area as outlined in the Lower Manhattan Plan, a study prepared earlier in the year. This study contemplated the eventual closing of some little-used downtown streets. We therefore investigated the possibility of closing Jones Lane, the street which separated the two sites. If this street was closed, the resulting site of 49,000 sq ft would permit a building of 880,800 sq ft with lower floors of 38,000 sq ft each and tower floors of approximately 20,000 sq ft. This possibility substantially improved the investment potential of both sites, and consequently we contracted to lease the two sites, subject to our purchase of Jones Lane from the City of New York.

Zoning Variance Required

Our preliminary studies of potential tenants' requirements showed that the minimum-size floor for the market we anticipated was 35,000 sq ft. Zoning permitted us to build 10 or 11 of these floors.

We then asked, "Is it possible to modify the zoning code to permit the erection of a building containing all large floors?" The purpose of limiting tower size of new buildings was to provide light and air in congested areas, but the proposed site stood near the bank of the East River, and light and air supply was not a problem. Furthermore, a tall tower would block the river view of many more tenants in buildings back from the river. We decided that we had an excellent reason to request a variance that would be advantageous to the potential tenants, the city of New York and ourselves.

The architect selected for the project was asked to develop bulk building studies on the expanded plot to provide floors of 35-40,000 sq ft each. With these very preliminary plans, we quickly had a number of tenants interested in leasing space, and within 40 days we agreed to lease the entire building to a major New York bank. In the letter of intent entered into with the bank, we were given time to close Jones Lane and get a zoning variance to permit larger floors. The rental was agreed upon, and the services which we were required to perform and the general quality of the building were set forth.

Let us review for a moment the project up to this point. We had committed ourselves to a site and, based on the requirements of potential users, we had established the mass of the building. Our gross income and expenses had been analyzed. We had determined a profit acceptable to us and, using the residual method, we arrived at a flow of income attributable to the cost of the building. By capitalizing this income flow, we were then able to work out a building budget.

And so, before any design studies have been undertaken by the architect, the size and general shape of the building have been set and a budget has been established.

I have outlined this process, not to show how indifferent investment builders and potential tenants are to design considerations at the initiation of a project, but because this is the typical process followed in the creation of most major office buildings by investment builders and developers in areas where the price of land is very high, necessitating the maximum utilization of permitted FAR.

The Architect's Role

At this stage of a building development, what can the architect do to create good design? How much can he or should he be innovative? In this instance, the design studies conceived by the architect and the tenant's design consultant indeed showed that a great deal of innovation was possible. But, innovation is not always appropriate or good architecture. Many meetings were held, many designs were considered. We considered inside our buildings strong horizontal expression, strong vertical expressions, an all-glass facade, a no-window facade. The design solution eventually agreed upon featured vertical pilasters of white precast stone, extending 18 in. out from the face of the building, on 24 ft centers. The pilasters were set off by contrast to the continuous dark glass used for windows and spandrels. But design is not just in the selection of an exterior treatment for the building. Design consideration must be given to the plazas, arcades, entrances and lobby and of course, to the tenant areas.

As each of these design problems came up, alternates were considered and a solution was approved by us as owner. My task, as project manager for this building, was to consider all of the many different demands placed upon the project and to bring these demands into some kind of reasonable order that would satisfy us, as investor; the tenant, as occupant and user, and all of us, as creatures sensitive to our environment.

Where possible, the architects' preferences and tastes were followed. I can recall one instance where we discouraged the use of the 18 in. pilaster projection because of our uncertainty about its final cost in place. The architect however, made a strong case for its use, stating that the pilaster was one of the principal design features of the building. I can report that most of the stone is now in place and the architect's concern about this design feature appears quite justified. I might also add that our concern about the cost was equally justified.

Control of an office building project therefore, is the art of achieving the best possible results from circumstances. Control is optimal when the demands of society—functional, public financial contribution and esthetics—are fairly served, and when the developer receives adequate compensation for his time, capital and expertise, encouraging him to seek similar investment opportunities.

The entire process that I have outlined treats design as a stepchild of necessity, and many design professionals may argue that earlier and more thorough consideration should be given to esthetics. Indeed, in the past several years countless books have been written about the lack of architecture in the city. Many of these critics have not hesitated to lay the blame at the feet of the developer. We have received more than our share of severe criticism and have often been alluded to in the most derogatory terms. The logic behind much of this criticism is that a renaissance of the beautiful city will follow closely behind the removal of insensitive, selfish developers who build for a profit. If one accepts the selfish-developer theory, one must conclude that an army of elected officials, financial institutions and corporate users of space are in league to destroy the central city. One book of city criticism in fact suggests that in its title.

Russell Baker in The *New York Times* summed up this attitude rather well when he said, "Americans are surely the world's most passionate blame fixers. When things go badly, their first instinct is to find somebody or something to blame. . . . The hunt for someone on whom the blame can be pinned seems to occupy us more intensely than the central problem."

Good Design vs Good Business

In the instance of the office building as built by developers for competitive rentals (this is about 75% of the space built in New York in the past 20 years), most critics have failed to recognize the central problem: that good design has not always proved to be good business. Almost every developer is sensitive to esthetic consideration and attaches great importance to the impact of his finished product on its environment. We all want to take pride in that which we create. There are few developers who would argue that we could not do better than we have done in the past. But how?

I believe the basic approach to improving office building design should be to give investment incentives for good design, rather than suggesting that we should move away from profit orientation in building. When good design is good business, developers will become the Medici's of the 20th century. Happily, if we study recent major office buildings, in New York and around the country, there is a clear indication that design has recently become an important sales tool for developers, and in a way it can be said that market demand is rapidly upgrading the quality of architecture. But more can be done. In many instances, municipal authorities who have long clung to the mathematics and formulas of building codes, with little or no flexibility, have begun to use this power for planning advantage. In New York City, the old building code allowed a builder to build a fixed amount of space, subject to the structure's conforming to height and setback regulations. Under the new building code adopted several years ago, bonuses are given for plazas and arcades so that a builder can construct 20% more space if he provides open areas. These bonuses have produced better architecture under the new code. However, height and setback regulations and the physical limitations of the New York City block are again creating a certain sameness in the mass of city buildings.

Quite recently, New York has been encouraging developers in many areas of the city to be more innovative about the location and massing of structures. There is now a clear attempt to promote over-all planning. To encourage developers, there have been indications that the city will give special bonuses or consideration where the design and/or services provided are in the general public interest. This type of bargaining benefits everyone if it is done sympathetically to everyone's interest.

Architects can accept the challenge of producing good design under budget restrictions, and many have. We currently have a project under way in Rockland County, New York, where we are constructing 4 million sq ft of office space in a centralized complex. The complex incorporates a full range of tenant and business services never before available outside a major city. Total planning and design are of paramount importance to the project's success, but every dollar planned and committed must be recovered in rent. Necessarily, the project has a tight budget. The architects, on their own initiative, have taken on the challenge of seeing just how inexpensively good design can be achieved. The results have been dynamic and exciting, and the finished complex should be a source of great pride and satisfaction to everyone.

In the same manner, material designers and manufacturers, engineers and city planners can strive to improve and simplify product design and lessen unit cost.

Many of you represent institutions which are prepared to build outside the limitations of return on investment. By all means, be innovative. If developers cannot afford to take many unproved steps and experiment with untested materials and designs, we certainly can learn from watching. An innovation successfully executed will find many imitators.

I am not representing myself here as an industry or company spokesman. My remarks should be interpreted only as my own; but there is a characteristic common to almost everyone in our industry. We strive to do better with each venture, better for ourselves but also better for the community we try to serve. And so we arrive at the point that one must reach if problems are to be solved—the point where all parties recognize each other's interests and, rather than getting our way by bludgeoning the other point of view out of existence, we seek a solution that gives something to everyone. This is the American tradition, and while we may arrive at this point a little bloody from past combat, I think we should all take another look at each other's problems for our own enlightened self-interest.

ARCHITECT
DEVELOPER
MANUFACTURER
GOVERNMENT
USER

and the Office Building

by Joseph C. White

The involvement of the manufacturer in office building is *minimal.* In almost every sense. As a member of the building team, he is at best a junior partner. In terms of his own potential commitment, his involvement is minimal. It is paradoxical. The market needs help; the manufacturer has the resources, the capital, the technology, the management skill—yet his involvement remains minimal. Why?

The manufacturer in the building industry operates in a different context than he does in other industries. The Arthur D. Little Report to the National Science Foundation, entitled "Patterns and Problems of Technical Innovation in American Industry" (September, 1963), states the case very well.

"The building industry is difficult to study because it is not an 'industry' in the sense in which the traditional textile and machine tool industries are. The assembly of groups devoted to the building tasks contains no one group of companies traditionally responsible for 'building' as the old-line machine tool companies have been responsible for making machine tools or the old-line textile mills have been responsible for making cloth.

"The 'building industry' is made up of an estimated 85,000 general building contractors; 9,800 architectural and engineering firms; materials suppliers; Federal, state, and local governments each with multiple controlling groups; building workers and their unions; brokers, realtors—and entrepreneurs of building enterprises and their financial backers. This total activity amounts to some $40 billion per year, or 7½% of the GNP in 1961. Its dollar volume has been rising steadily since 1930.

"Of the various groups involved in the industry, no one has controlled a dominant share of the building dollar. Designers and builders each derive less than 1% of the total expenditure as profit, and divide this profit among about 90,000 organizations. Several hundred different firms may supply material and components for a particular building; and for many of these firms, building may be only one of many markets for material, or a building division may be only one of several divisions in the company.

"The problems of innovation in the building industry are, at least in part, the problems of continued industrialization of building activity. The building industry is now pursuing a course pretty well completed by most major US industries—a course which has taken them from decentralized to centralized operation, from fragmented to more nearly unified structure, and from craft-based to technically-oriented manufacture. But the building industry poses the additional problem of being necessarily a decentralized process—so that its problems of innovation are, in part, problems of how it is possible to bring manufacturing sophistication to an activity which is bound to take place on hundreds of thousands of decentralized sites.

"This reflects itself in the fragmentation of the building task. The building industry is fragmented on two levels. First, it consists of thousands of small companies. Second, these small companies represent different segments of the building task: architects, structural engineers, contractors, manufacturers of components and materials. Each performs his function in terms of his own standards, needs, and problems. Each wishes to maximize profit to his own area. No one is responsible for the building task over-all. And yet, major innovation cannot fail to affect all parties to the process. This means that an innovation cannot be implemented unless all the bases are touched. Architects and contractors alike must be sold. The materials and component manufacturer must seek to please them all. But their interests are not always compatible (architects may favor good design and principles of sound structure, and contractors may be primarily concerned with reduction of costs and of labor problems on the site) and many of them may be below critical size for innovation."

A Problem of Scale

The fragmented, craft-oriented nature of the building industry has resulted in the manufacturer being a small company or a division of a large company. You would look in vain through *Fortune* magazine's 500 largest industrials for a corporation devoting its full attention to building. There isn't one. Our nation's largest market, construction, has no set of large industrial corporations exclusively devoted to serving it. It seems that the problem we are discussing—how to build office buildings better, faster, cheaper—is a significant problem of large scale. It should require a large-scale solution and if this solution is to be a typical American one, it must involve large industrial corporations. And the involvement of the large corporation must be a significant one—a commitment of resources and technology—a commitment of management skill applied to the actual process of building. How does the market obtain this commitment? Let me explain the manufacturer's dilemma.

According to Peter Drucker, the purpose of a business is to create a customer. With this as the purpose, there are two basic functions of any business enterprise: marketing and innovation. He says in his book, "The Practice of Management," "The economic revolution of the American economy since 1900 has in large part been a marketing revolution caused by the assumption of responsibility for creative, aggressive, pioneering marketing by American management. Fifty years ago the typical attitude of the American businessman toward marketing was still, 'The sales department will sell whatever the plant produces.' Today it is increasingly, 'It is our job to produce what the market needs.' "

The American businessman cannot understand the building market. He knows it is vast and very important but he has yet to find the way to exploit it or, put it another way, satisfy its needs. The market is disjointed and amorphous, and the businessman's means of communicating with it are indirect, filtered many times, and almost always after the fact. To create a customer it is necessary to identify, then communicate with, the decision maker, the individual with the need to be satisfied. In the building market, the decision maker is the owner and his requirements are interpreted for the manufacturer. He has not found a way of communicating directly, and even when he does there well may be a language barrier. The building owner and the manufacturer, being businessmen, understand the language of merchandising and finance, but neither understands sufficiently well the language of building. The owner, faced with increasingly-severe problems of building, is learning the language. The manufacturer, insulated from the problems and the process, has yet to learn the alphabet.

Learning the Language

I think there are three reasons for the manufacturer's linguistic hangups—the reasons he doesn't understand the building process.

First, he enters the process after the fact. The office building is in the design stage and all the basic decisions have already been made. He is given no opportunity to examine the problem comprehensively. Typically, he is asked the question "Could you make this?" after being presented with a sketch or drawing. He takes the sketch back to the factory, and the resulting

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research concerns itself with modifying existing tooling for this particular job. Manufacturers many times call this process "product development." The resulting product, which often is ill-conceived, is then added to the manufacturer's bag as a standard and before you know it his competitor has matched him.

This process of product development leads to misdirected research. We have to make this product better—our competitor has one now—isn't there a way for it to do more things? So the computer and the research facilities go to work to improve a product conceived by a designer whose chances of being comprehensive in his outlook are probably not very good. Once a manufacturer steps on board this merry-go-round he finds it very difficult to get off. This approach, or variations on the same theme, become the manufacturer's innovative method—a serious misdirection of his substantial research and development resources.

Second, his marketing resources are dissipated.

Not being able to communicate with the owner, the manufacturer becomes a vendor to the owner's interpreters, the 9,800 architectural and engineering firms, and a portion of the 85,000 general building contractors. His marketing managers must use their expertise on learning the politics of the system, how to influence a specification, how to bid a job, how to circumvent an "or-equal" clause, rather than determining the true needs of the customer and interpreting these needs to the corporation so that a strategy can be developed to satisfy them.

Industrialized Solutions

Third, the manufacturer does not usually install his own products. Another member of the team installs and most manufacturers like it that way. The process is chaotic, at best, and the manufacturer generally feels that he shouldn't ask for any more problems than he already has. The ideal policy for him is to sell the product "material only." There may be a trend toward reversing this policy. Contractors are interested in larger packages today and are beginning to force manufacturers to bid their products installed. This is a hopeful sign. The feedback effect, usually missing now, will force manufacturers to be more responsive to needs, and to begin to understand the building process.

But, regardless of the reasons for the corporation's hangups, he still possesses the capital, the technical resources, and the managerial skill to solve the building problem, even though he squanders these assets at present.

The statement that this large-scale problem of building demands a large-scale industrial solution generally meets with objections. Present participants in the building process hope that somehow the solution can evolve with the myriad entrepreneurships that make up the present team. So far, this has been a vain hope, and meanwhile the problem gets more serious.

When the Vietnam War is finally ended and we face up to the task of building a second America by the year 2000, it seem inevitable to me that a summit conference will be arranged to bring the owner and the large corporation together. It is difficult to know who will take the initiative. The Luckman-Ogden merger indicates it might be the corporation. The Federal government Public Building Service project indicates it might be the owner. I would hope that the two parties, when they do meet, would communicate in the language of systems analysis. It is the language of business, a language that they already understand. It is becoming the language of architecture and building. By using it, comprehensive solutions which get to the heart of the building problem can be developed.

The Chance Manufacturers Take

From the manufacturer's standpoint, the challenge of product research and development to meet needs of the innovative designer is a risky business. Perhaps the thorniest problem of architects and engineers working within the discipline of systems and performance concepts is that of guaranteeing a sufficient market to make the required R&D effort worthwhile for producers. The problems are compounded when the components must be mutually compatible, when they must meet rigid performance specifications, and when the bid price must be the installed price.

A case in point is the URBS (University Residence Building Systems) project. The University of California is the client; Building Systems Development, Inc. is the project coordinator.

The bid-opening for URBS components, held in midsummer, attracted national attention, especially when the architectural press reported that the apparent low composite bid (on five component categories—structure, HVAC, partitions, bathrooms and furnishings) came in 38 per cent over the estimates. In two component categories, all but one potential bidder had dropped out prior to the opening.

A spokesman for BSD, Inc. explained that the lump-sum bids were misleadingly high, since they cover all of the options to be provided as part of the palette available to the designers of individual buildings. Translated into unit costs, the price would be well within allowable limits.

Manufacturers, in deciding whether or not to bid on the URBS components, had to decide whether the residence-hall construction planned by the University would provide a sufficient market to justify the effort (although other applications are feasible).

Industry will be watching URBS intently, to see whether the successful bidders are in fact the winners —or the losers.

ARCHITECT
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and the Office Building

by Karel Yasko FAIA

The essence of the design of Federal buildings is to solve the program of requirements with a quality of excellence, efficiency and economy, while creating an environment conducive to the stated function. Substitute the word "all" for "Federal" in this ponderous statement and the responsibility of the private architect and engineer is also defined.

It has been said that there is no substitute for experience—even genius. We learn from our errors and profit from our successes. But who knows, in the design and construction of buildings, which has been achieved and in what areas? The most common measuring device has been the owner's complaints. Unfortunately, some clients become so annoyed over even a single inconvenience, because they expect perfection, that they won't even bother the designer or builder, preferring to damn them on all counts. And in the whirling scheme of things in our present culture, there is no time allowance for assessment of the end product. The architect is busy chasing down more projects to feed the demanding office payroll; the engineer is engaged in the same pursuit, and the contractor is loaded with his construction schedule; none of them takes time out to return to appraise, in its working state, the result of their joint effort, unless the client makes an insistent demand for their joint presence. Then it is usually to take care of isolated problems; rarely, if ever, to evaluate the entire project against the original objectives.

The opportunities for continued errors in planning, equipment and materials, to mention only a few items, are constant due to ignorance of performance.

The Public Buildings Service of the General Services Administration is involved in a building program each year, unmatched in size by any organization in the world. The variety of types are as many as Heinz's, with office spaces leading the list, appropriately, for our discussion today.

Providing the Feedback

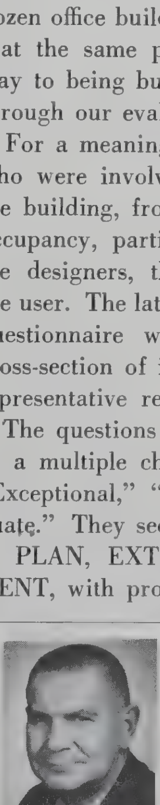
For some time, the Public Buildings Service has had a valuable reporting system of newly-constructed and occupied buildings to appraise the immediate operational performance of design and construction components after six months of use. An operational evaluation, it serves as an occupancy "punch-list."

To this we have now added a one-year evaluation intended to go beyond these items to the larger scope of planning and design as well as construction. By this time, the building occupants will have experienced the created environment in which they work and will have firm reactions. Also, the impact of the building on the community will be more susceptible of appraisal as to its immediate contribution to the immediate environment.

The specific objective, naturally, is the continuing improvement of the facilities in the future building program. The feedback resulting from the evaluation of completed and occupied building offers the most constructive source for improvement. The size of our normal building program, in which we may have a dozen office buildings under design concurrently, means that the same poorly-designed element can be on its way to being built in 12 structures before it is revised through our evaluation process. That can prove costly.

For a meaningful evaluation, it is important that all who were involved in the design and construction of the building, from site acquisition to construction and occupancy, participate. The key figures, though, are the designers, the architects and his engineers, and the user. The latter makes his report through a building questionnaire which is distributed to a percentage cross-section of individuals in the building to obtain a representative response from janitor to top executive.

The questions are simple and direct, "yes" or "no" or a multiple choice type offering grades of reaction, "Exceptional," "Adequate," "Indifferent" and "Inadequate." They seek responses in the three defined areas of PLAN, EXTERIOR, and INTERIOR ENVIRONMENT, with provisions for the user's comments if he



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believes that checking a box is not a sufficient expression of his opinion.

The results are summarized and given to the evaluating team with a guideline checklist to be used in the on-site evaluation. Gathering the design and construction participants at the building, where the assessments can be made together, is one of the most important aspects of the evaluation. It is vital that all be present so that the absent one isn't blamed for all the deficiencies.

Criteria Revised

The on-site checklist is directed to "The Building is its Environment," "Site Plan and Landscaping," "Function of the Plan," "Interior Environment," which form the basis of inquiry but not the limits. We expect each team to find additional appropriate areas of evaluation.

The first reports of 10 Federal office buildings (one in each of our 10 regions) have been prepared and subjected to general analysis. Actions have been implemented in certain areas through revisions of our criteria, and other possibilities are being evaluated. The responses to the user questionnaire are being tabulated, and present an interesting picture of individual reactions to planning and environmental design. Since the program of one-year evaluations will be a continuing one, we won't attempt to draw conclusions until we have reports on a greater cross-section of our building program.

It is possible to comment at this time, though, on reaction patterns which appear to be taking form.

As an example, in response to the request to rank five elements of "work station environment in order of importance" there is a 1-2 pattern for illumination and air temperature (heating, ventilating, and air-conditioning).

A most surprising result is the placement of "sound control" and "visual appearance" at the bottom of the list of importance to the individual, although in one southern city "sound control" was listed ahead of "illumination."

Yet, almost without exception "illumination" was cited as "*most* satisfactorily met" and "air temperature" as "least." When the user's comments on this become extensive you respond instinctively into investigation and find the team's report describes the problems and actions already being taken. It appears that technological advances in mechanical engineering directed to created human environment don't produce automatic solutions, especially when the environment is not static. The demand for flexible office space which permits relocation of partitions almost at will, even with planning modules (ours is 5 ft generally), seems to have placed the greatest burden on mechanical systems. A common request from occupants of office spaces, other than large open areas, is for individual room thermostats, on the theory that this will overcome *their* problems.

Because government offices are large by the nature of the services being furnished (some agencies require several floors of 15,000 to 18,000 sq ft gross each), it is obvious that not everybody can have a window or be within 25 feet of one. This became an important question put to the users, who responded in singular fashion to the three-part query. The pattern indicates, at this time, that of those people now working within 10 feet of a window, a greater percentage claim that a window view is a "moderate improvement" in their working environment; a smaller number, those within five feet, claim a "significant improvement." Asked how a change of location with respect to a window would affect them, over 60% had no opinion while only 20% said it would be good. It is the group with "no opinion," we believe, which is significant and should concern those who insist that everyone should have a window.

User Reaction

The importance of color on the walls appealed to more users as "moderately important" than "very important" though there were significant numbers who were "indifferent," and a percentage believe that colored walls are unimportant.

The indifference shown in many categories gives pause for wonder, even when it is shown toward "visual variety (plantings, flowers, more than one color)" in office space. Approximately 40% found them "moderately desirable" and about 30% "very desirable."

At the same time, about twice as many people believed that wall and floor materials in their work location affected the quality of the environment as felt they had no effect.

Overwhelmingly, and in some buildings unanimously, the users found their building "as a whole, a pleasant place to work." In one building, where the response was enthusiastic throughout (except for "more vending machines"), a single soul disliked everything about his place of work.

In a final broad question, users were asked to indicate whether they believed the environment provided in their building had any effect on (1) work habits, (2) clothing, (3) interaction between fellow workers, (4) interaction between supervisors and, (5) work performance. Work habits and work performance received the greatest "yes" votes with the other categories also on the positive side, except in one building. The questionnaire for this building broke down the "yes" column into "good" and "bad," in addition to the "no effect" column. The significance of the answers here is that there was an appreciable number (12%) who found the building had a *bad* effect in these areas.

To add confusion to the results, 92% found the building "as a whole a pleasant place to work," and the 8% who did not comment are less than the 12% who felt that the environment was bad for them.

There are other areas in which we questioned the users but these are the highlights.

We now have to question ourselves, because of the general uniform patterns, whether the answers are those of Federal employees or will they apply to private offices as well. We believe that, except for minor situations, they are those of every office worker.

ARCHITECT
DEVELOPER
USER
GOVERNMENT
MANUFACTURER

and the Office Building

by Francis Duffy ARIBA

Why should architects concern themselves with social conditions in office buildings?

This is not a question to be taken lightly. Immediately it lands us in the thick of one of today's most bitterly-fought arguments about design. On the one hand are ranged those architects, good, honest, bluff fellows who motivate themselves by believing that their buildings are making people do more or live better, happier lives, that buildings *determine* people's behavior. So if, for example, you design housing on the neighborhood unit basis people *will* become more neighborly. Every now and then these *architectural determinists,* as Broady[1] calls them, find some support among social scientists but on the whole empiricism is not so important to them as the feeling that they are somehow doing good.

Facing and attacking them are some of the few social scientists, considerably more in touch with what data exist, who are sufficiently interested to admit that buildings may influence behavior but who really regard buildings as something independent of human activity—like music to a film, parallel but not a shaping force.

Which side ought you to take—both, one or neither? This decision, I believe is *crucial;* for if you are an architectural determinist, your attitude to social conditions in office buildings depending on your viewpoint must become cheerfully paternalistic at best, or grimly exploitative for the sake of higher productivity at worst. If you adopt the second attitude and regard buildings as neutral in relation to behavior, then there is no point in troubling yourself further with these worries. Architects are wasting their time if they study social conditions in buildings.

The history of this argument is very interesting and its significance extends well beyond architecture. Architectural Determinism or more widely Environmental Determinism is an old idea, dating back to the work of geographers[2] before World War I. Some industrialists assumed that environmental conditions could increase or decrease an employee's output, just as earlier, pure water and good drainage had been proved to lower the death rate in cities.

The famous Hawthorne[3] studies in the 30s were the first thorough test of this hypothesis. Of course, these studies revealed that there were other factors influencing employees' productivity besides levels of amenity. Raising light levels increased productivity but so also did lowering light levels to a point at which the workers could hardly see their work. The notorious "Hawthorne Effect" had been discovered—the workers' interest in their work was stimulated by the compliment of being observed. After these studies it was no longer possible to conduct environmental research which dealt only with overt stimuli and responses. The consequences were enormous: In industry there was a swing away from human engineering to human relations; among social scientists there was a rapid decline of interest in environmental variables; architects became even more cut off from the stimulus of good empirical work in their own field. The question of the effect of the environment on man was *not* closed but hidden, swamped, under hundreds of new preoccupations. We are still suffering from the Hawthorne trauma and it is only in recent years that a handful of sociologists, social-psychologists and psychologists have begun to interest themselves again in the environment of buildings. What work will they do and what use will it be?

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This is why it is crucial today for architects to decide what their attitude is to the social and behavioral sciences. Does behavior determine design or not; if it does, how far does it shape design? My own answer is direct and all-encompassing. I recommend it as a model for busy architects and inquiring scientists.

Buildings provide a framework for behavior. They exist only to allow people to do what they want to do. Often they fail in this task and get in the way of what people want. Signs of this can easily be found in offices, small stray examples—doors left open permanently, departments not able to share the same part of the office floor, nowhere to pin notices or pictures—which show that the building is in one way or another failing to give people's wishes and tendencies free play. Other more underground effects of the failure of an office building may be expressed not by abuse of the building but by indices of unpunctuality or absenteeism, deeper symptoms of the workers' unhappiness.

I suggest that rather than neglecting the relation between buildings, organization and behavior, or attempting to use buildings to exploit behavior patterns, it is sanest to try to design buildings and organizations which permit all possible behaviors to coexist without coming into conflict. I do not mean coexist in a compromised way, however, but real coexistence in their entirety, of *apparently*-conflicting sets of tendencies such as the management's wish to get so much work done, and the office worker's wish to be able to feel at home in the office.

Perhaps this is an impossible ideal; certainly it is a strong hypothesis. I look forward to refutation. Until that comes, however, I am going to use it as the foundation of my whole argument. This is the only way I can see of accepting the promise of data from the behavioral sciences, without having to take sides in regulating its use.

My model contains three sets of variables: those which are about the organization of work; those that concern the way people behave at work, and those to do with the physical disposition of the office environment—in short, job, worker and building.

My argument is that given a certain job, say that of a lawyer, there can be isolated a basic organization or work, which together with the predictable behavioral patterns of lawyers, their clients and their assistants, will lead to typical locations, plans and furnishings for a lawyer's office. Obviously such basic arrangements may be modified or transposed depending on personal whims, and on what resources are available. Nevertheless, they always remain basically the same, until, as time passes, organization is improved or customs and behavior are modified.

Such a model provides a sound basis for architects to design offices because it is based entirely upon *real* evidence about jobs and workers. Obviously it provides the motive for architects to demand useful and appropriate applied research from the organizations and behavioral sciences. Because architects will be accustomed to seek generalities as well as to find peculiar local features, they will appreciate the value of scientific data. The behavioral scientist, on the other hand, will understand why the architect wants his research and what relation behavior has to organization and buildings. The same will be true of the student of organizations.

A change in one of these sets of variables is likely to have repercussions in the others. My preoccupation is to discover what these relations are and how they work, and my aspiration is to design a set of generic building relationships or patterns that may be elicited by appropriate combinations of organizational and behavioral variables. I recognize that essential relationships are likely to be transformed but not destroyed by local circumstances, different resources or individual preferences.

It is worth pointing out that this kind of investigation of complex relations is made possible only by the tech-

Model Variables

Organization of Work—*The Job*	whatever is directly to do with getting the work done, e.g., the task to be completed, the line of authority and responsibility, work communication channels, management style, equipment used, numbers of visitors, etc.
Behavior at Work—*The Worker*	the social consequences of getting work done, e.g., display and prestige, work expectations, visitor expectations, informal groupings, communications, sex, age, income, education of the workers, secrecy required, etc.
Building Form—*The Building*	the physical consequences of job and worker, e.g., location, space and equipment standards, disposition of groups and workers in plan, arrangement of equipment, size of room, use of partitions, screens, room dividers, etc.

niques of operations research, which allow us for the first time to discover and plot "systems connections" between fields that were previously thought to be, to all intents and purposes, divorced. For example, industrial engineering and social psychology were once quite separate fields and the practitioners in the former tended to know all about machines and nothing about people, and vice versa in the latter case. The new "socio-technical" [4] approach embraces both fields and relates them by the same systems language. What I am doing is simply to extend one kind of socio-technical system to include another set of phenomena, making it a socio-technical-environmental system for offices.

Before I go on, I should mention what I mean by "office." I do not mean only prestige office buildings housing large corporations. I mean all places where professional, administrative, recording, accounting activities are carried out, whether in factories, surgeries, shop windows or prestige blocks—any place in which the people who used to be called white-collar workers work. I realize that automation is making some office tasks very like factory work, but since I think a workable distinction between the two can still be made, and since I don't want to be drawn into factory design, this problem will be left alone.

Generic Relationships or "Patterns"

The idea in design of generic relationships or "patterns" has been taken furthest by Christopher Alexander at the Center for Environmental Structure in Berkeley. The work that is described in this paper has been carried out under his guidance and reflects his ideas.

A pattern is a building block, or an atom of design. It is the smallest isolable relationship between physical objects which resolves a conflict between desires or tendencies. A door is a version of a pattern: One person wants enclosure, another wants access—a hinged or sliding piece of wall is the answer. This is a very simple-minded example but it serves to show how a pattern is a complete resolution, not just a compromise based on weighted values. Moreover, it demonstrates the generic nature of the solution. Doors can be all shapes and sizes, made of many different materials, but underneath all this bewildering variety is still the essential pattern idea of an operable barrier. Most important, the essential idea of an opening is based on fact, because it can be shown empirically that people *do* want enclosure in certain circumstances, and that they *do* want access, and above all that the door *does* in fact satisfy these real tendencies.

The relevance of patterns to the job, worker, building model should now become clear.

The model is an overview of all the relations between organization, behavior and building form that come together to make the office building. It is a kind of aerial photograph of an important area of architectural concern. The patterns are the elements that fit together to make this photograph. They are the way that each isolable relationship is made possible in physical terms. Patterns are building blocks, resolved problems, great and small, that may be fitted together in an infinite variety of ways, to build the design of an office floor or an office building.

So the argument using the model runs thus: If you have the organization of, say, a lawyer's office, then certain kinds of behavior may be predicted; therefore such and such a physical form is appropriate. Such an argument is nothing less than a grouping together of the appropriate cluster or galaxy of patterns.

Such patterns may be stored and retrieved mechanically, given the appropriate cues. Not the least advantage of such a system is that it is far more sensitive to design problems at all levels than any alternative method, and yet it avoids the designer's drudgery of laboring through every design problem from the very beginning.

The Present State of Office Design

Of all the areas of architectural practice, office design is probably the most poverty-stricken in ideas, in innovation, in sensitivity to human needs, in allowance for organizational structures. Schools, hospitals, housing have far more social and organizational thought put into them. I have never understood how good architects, who do not hesitate to discover the minutiae of an indvidual client's taste for a house, switch off 90% of their normal inquisitive conscience when it comes to the design of office buildings, concentrating one one or two dominant concerns such as structure, and proportion of "usable" office space. Now, I am prepared to answer attacks on the pattern-language on the grounds that it concentrates too much on the generic and is liable to be unable to cope with whatever is peculiar and local. However, my defense is easy compared to the case that conventional office architects would have to prepare, if the same charge were brought against *them.* How well do they meet the client's needs? How many types of office building are there? Look at a set of student schemes, or at a book like Joedicke's[5] "Office Buildings" and you will see the whole conventional range of types—single-banked, double-banked, central core, open layout, air-conditioned or not. There is hardly a word about how to decide when each type is appropriate, hardly a word about the dreary business of what goes on inside.

It's amazing that the client ever gets his men inside the buildings. Perhaps the problem is easy. I don't think it is, and, in fact, it is generally a coalition of office managers, sensible but unimaginative men, and interior designers, who are too lowly to emulate the architect's bland unconcern with client needs, which succeeds in making these buildings habitable. This might not be such a bad situation if the over-all decisions made by the architect were sensible, but often they are the opposite—wasteful, inhibiting and inflexible. No wonder people are always telling you how inconvenient their office space is!

There is some excuse, of course. Architects often design their buildings for real-estate people, developers who don't know who their tenants are going to be and who want to attract as wide a range of likely tenants as possible. This is not a position that encourages detailed study of client needs. But this can't be the *whole* answer, for the same simplistic designs recur in buildings designed directly for the client.

In Germany in recent years, some very interesting innovations[6] have improved this dark situation. You have probably heard of office landscaping, the big open floors where apparently-random arrays of desks are screened or partially screened from one another by little portable partitions and tubs of plants. Often office landscaping is dismissed as another version of the hated bullpen, only dressed up a little to make it more palatable. In fact, office landscaping is very much more than that, and deserves very serious attention, particularly in America, because the underlying ideas of management theory that the *Organizationsteam Schnelle* have the credit of putting into practice were developed here. They are using your ideas.

Office landscaping is based first upon a very thorough study of communications in the office; the net of communications is charted and optimized. Secondly, it is based on the concept of an organization as a series of interrelated and interacting groups, quite the opposite of the old hierarchical structure of the organization chart. Thirdly, and *only* thirdly, after the previous principles had been firmly established, was it decided that the large open floor with portable screens and desks provided the most controllable and flexible milieu for such an organizational structure. The Schnelles are, after all, management consultants, not architects, and it is their organizational flair, their background in management theory and operations research (together with a lot of imagination), that led them willy-nilly to the "architectural" notion of office landscaping. And, of course, it is this very organizational competence that architects are blind to when they grumble about this new idea which irritates them so much.

My criticism is on different grounds. The Schnelles are strong in organization theory and practice (organizational variables) but relatively weak in the study of behavior (behavioral variables). I must be careful of what I say here because they have introduced some important social improvements into offices, for example, the coffee areas with armchairs to which employees are free to go at any time. However, these improvements tend to be closely related to organizational goals of getting the most out of the worker. Moreover, their assertions about behavioral factors, such as the effect of not having a view, or even of being free to have a rest and a cup of coffee when you feel like it, or of being visible to your boss, tend to be optimistic and not very well supported by solid data. We just don't know the answers to these questions yet. Moreover I suspect also that they may be guilty of playing down the differences between different kinds of organizations, but this may be simply because they have always been consultants to rather similar firms. It would be interesting to see, for example, what they would recommend for outfits as different as a bank or a lawyer's office.

Nevertheless the Schnelle approach is incomparably superior to any rival I have yet come across. I hope that the early experiments with office landscaping in the U.S. will raise many questions about the relations between job, worker and building and will perhaps hasten the empirical studies that I should like to see made.

Tests to Evaluate Studies

In the same way as I criticize office landscaping because it fails to take into account behavioral variables, I find it necessary to take issue with a great many of the empirical studies of the office worker because they frequently fail to cope adequately with organizational factors. Frequently one is allowed to think that office work is a shapeless, characterless phenomenon which need not be discussed. The major point that I am making in this paper is that it is meaningless to discuss job and office building without considering the job. This awareness of interacting relationships is so important to me that I have established the *trident* test as a measure of the validity of empirical studies of the office. Quite simply the three-pronged test demands that *all* three sets of variables—organizational, behavioral and physical—are all accounted for in any experiment. Of course, one set of variables may be held steady—a legitimate and useful scientific device—but "held steady" naturally does not mean "forgotten about," as I am afraid, is often the case. In my review of office experiments I have wielded the trident test rigorously to rake through various entangled relationships.

Another test that I apply is the *utility test.* My aim is again very simple: I want to ensure that experiments are useful to a designer, that they tell him directly how to improve the design of offices. Perhaps to the social scientist my stress on utility may seem hysterical, but to me, an architect, starved of hard data all my student and working life, it is a matter of vital necessity. In effect work in which the building form variables are kept steady is, in consequence, rarely interesting, unless of course a deliberate attempt is being made to chart how wide a range of organizational and behavioral variables the same building form can accommodate.

Studies of Job, Workers and Buildings

I shall attempt to survey the present state of empirical studies of office work, workers and buildings.

Do buildings matter? is the first question to ask. Unfortunately it is difficult to give a straight answer to this question, although two recent studies have attempted to provide one. The first is by Dr. Langdon[7] (Langdon 1966a) of the British Building Research Station. Langdon's work is based on a survey of user-attitudes to postwar office buildings in central London. When 9,300 office workers were asked how important a "comfortable office" was to them compared with such other factors as "responsibility" and "good pay," they gave the answer which one half-expects—not very. On the other hand they did not judge a "comfortable office" as the least important part of their work experience. The second survey of this kind, which by contrast is rather thin and unmethodical, is an American study by J. T. Fucigna[8] (Fucigna 1967) and is a before-and-after study of the effect of some new and well-considered furniture on the work-habits of three consultants. Very little difference was found in the amount of time these men spent at various office activities—reading, writing, phoning, etc.—during the two months that were being compared.

I don't think we have enough evidence yet to make up our minds on this question. Fucigna's study—although interesting because he is one of the few people who have studied "executive" habits in detail—suffers from too small a sample, and inadequate indices of productivity. In Langdon's case we encounter the fundamental difficulty that *asking* people what is important to them does not necessarily bring out the real issues. Noise happened to be a nuisance and was mentioned a lot; comfort was presumably adequate and was therefore paradoxically underrated. Had Langdon chosen the sample of offices that Dr. Robinson[9] surveyed in his investigation of *all* offices in the city of London, many of which are very old and run-down, perhaps the user reactions might have been quite different.

The User and Building Form

One cannot fail to be impressed, however, by the body of user-satisfaction data that Langdon has collected in the second part of his study. His sample was enormous; the range of buildings studied, though new, was very wide. Reactions were noted to daylight, artificial light, internal wells, internal acoustics, external noise, heating, ventilation, security and space provision. Users were subdivided by age, sex and grade.

Overheating in summer, poor ventilation and external traffic noise emerge as major problems. Perhaps this may seem rather banal. In fact, there is no comparable body of facts on how well offices serve the people who work in them. The facts do not flatter architects. My reservations are that I am suspicious of user reactions alone without corroboration by other indices of success or failure. People sometimes use buildings to complain about something entirely different. Moreover, Langdon completely ignores all organizational variables and these may well have influenced user reaction. The study therefore fails to pass the trident test.

Perhaps more interesting from a sociological point of view is one of the surveys carried out by the Pilkington Research Unit[10] in the Cooperative Insurance Society headquarters in Manchester. Here people were shown a picture of a typical floor in their building and were asked to choose where they would like to sit. Eighty-one percent chose the row of desks immediately adjacent to the window. The most common reason given was "natural daylight" which is odd because as we shall see later people are not very good at gauging what is natural about daylight.

We have now encountered one of the great mysteries of office design—the importance of the window. I suspect that the people who answered "natural daylight" were simply failing to make distinctions between daylight, view and sunlight, the error that has bedeviled all research in this area. Markus[11] recounts a survey made at the new Robinson Building in Bristol and makes some very interesting points about the use of windows in offices. Most people (86%) say they want sunlight at their desks all the year round, but when asked to rank in order of importance good lighting, sunshine, comfortable summer and winter temperature, clean toilets, etc., most people put sunshine near the end of the list. Perhaps the reason is that they all enjoy sun anyway; perhaps rank ordering is not a meaningful device in this context. Similarly with view; view is ranked low in order of importance but nevertheless the majority (51%) of workers would prefer to be near windows. Complex factors are at work here—not just a simple feeling of being deprived of a view, but status and thermal and lighting conditions. The evidence suggests that both excessive brightness and the sensation of cold influence people—the one away from windows and the other towards them.

Markus has some interesting data and even more interesting intuitions. Much research, however, remains to be done although Wells[12] has some further data on this subject. A current British design orthodoxy is the alleged necessity of some component of natural light in any artificially-lit office. By comparing actual light measurements of natural and artificial light at various desk positions, to the estimates people make of the percentage of natural light, Wells found that people overestimate natural light the further away they are from the windows. Moreover, being far from windows had nothing to do with belief in the importance of natural light for the eyes, or even with estimates of the importance of being able to see out. You will notice that this result seems to be in conflict with another of Wells' findings—that most people in the deep offices of the CIS were anxious to sit in the window positions. Why should this be so?

Many other research questions are suggested by this confusion. One of the most interesting is, when does an internal view become a substitute for a view through the window? Banks, which have always been designed as internal halls with no vision to the outside world, might reveal some answers.

Noise is another aspect of building form which has been shown to affect workers. Langdon (Langdon 1965) has published an exemplary study (which incidentally completely satisfies the trident and utility tests) of annoyance caused by noise in automatic data-processing offices. Three types of staff were affected—clerks, card punchers, and machine operators—and it was found that annoyance, caused by the same noise level, varied according to the job. Each job it seems has attached to it certain expectations of the environment. But, of course, noise interferes with communication too and this is clearly more important in one job than another.

Sociometric Studies

Since Moreno[13] invented the technique of sociometry—measuring the interactions between individuals in various situations—it has been obvious that informal interactions in the office could be charted in this way. The famous American sociologist Homans[14] conducted what amounts to a sociometric study of office girls and one of his students, Gullahorn,[15] used a similar technique to show the relation between distance and friendship among a group of twelve invoicing girls ranged in three rows, separated by filing cabinets. He found that there was more contact within a row than outside it, and more contact with the adjacent rather than the further row.

Festinger[16] used sociometry to explain how friendships developed in a housing scheme, in perhaps the most famous of all architectural applications of the technique.

Wells in the wonderful Pilkington Study[17] (Manning & Wells 1965, Wells 1965b) has taken sociometric techniques furthest. In fact all of Wells' work strikes me as being full of elaborate methodological fireworks.

He compares the attitudes to the open office of three categories of staff—managers, supervisors and clerks. Managers prefer large open offices (needless to say, not for themselves); supervisors and clerks preferred the smaller offices. However, clerks who had experience in the large open offices are less extreme in their dislikes of others.

The sociometric consequences of larger and smaller offices are quite distinct, although age, sex and interpersonal distance all play their part. The people in the larger offices made, on the whole, a greater average number of choices, many of which were widespread beyond sections and even departments. People in the smaller offices tended to reciprocate choices made within their own section. On the other hand, these smaller offices contained more isolates. So you either get on very well with your neighbors in the smaller office or you are ostracized. But whatever happens you don't go further afield for friendship.

Wells tries to argue that there are direct implications for management in these findings. For example, management might be advised to choose smaller office rooms if it wishes to promote small exclusive work groups of high morale and efficiency. Or conversely, the large open floor might lead to a better sense of the whole organization. However, I'm afraid that Wells is stepping into the realms of speculation here. No relationship has yet been found between room size and productivity—a necessary index to give meaning and measure to the words "morale" and "efficiency." I have no doubt that such a link *could* be found, but until it is we must not anticipate. I think this is my best example of the distorting effect of neglecting organizational variables, because until the organization links have been found, all these sophisticated studies are practically useless to the designer. He can draw no firm conclusions from them. Perhaps you will understand a little better now why I stress so much the trident and utility tests.

Work Habits in the Office

There is an amazing lack of evidence about what people actually do hour by hour in any but the most mechanical office occupations. I suspect this is part of a universal white-collar self-defense conspiracy—"My job is so complicated it can't be rationalized." Two unpublished studies make one wonder how solid this defense really is.

Tennant of the Stanford Research Institute[18] (Tennant 1966) has compared the time spent by similar researchers in two quite separated research establishments. It had been assumed previously that entirely different habits and customs prevailed in each center. In fact both groups were found to spend almost exactly the same amount of time on the telephone, talking face-to-face, etc. This is not to say that the individual scientists were not doing creative and original work; only that there are obviously generic types of even the most complex work which can be classified for the benefit of the designer.

Another study of IBM programmers[19] (Bairdain 1966) is equally interesting. An argument is made for privacy from interruption and distraction for computer programmers who often do complicated and difficult work. However it is found that pairs of programmers sharing rooms are subject to interruption and distraction once every 110 seconds, more than once every two minutes. A further survey of 10 companies reveals that programmers, like everyone else, are customarily allocated rooms on "company policy," not in accordance with their real needs. However, eight of these companies are in practice forced to allow their programmers to use extra rooms and quiet corners to do their work. Perhaps such muddles would be avoided if, in future, the actual needs of office workers were better understood at the beginning by management and designers.

I have described these studies because they are practically all I have ever found directly on this subject. Obviously they are inadequate, and chart only a few of the many possible interrelations between organization, behavior and building. However they are enough to suggest research techniques that will be invaluable in the future. And certainly already some ambitious projects are underway. In America, E. T. Hall, the anthropologist, is in the middle of a five-year study of the Deere Headquarters in Moline, Illinois. In England, David Canter is studying the relation of office size to productivity. Moreover, work parallel but not directly related to office design is being carried on by psychologists like Sommer[20] and Argyle[21] and sociologists like Goffman.[22] Perhaps things really are getting better all the time.

If behavioral and social scientists are really becoming more interested in environmental problems, designers should get ready immediately to direct scientific interest towards the problems that are most pressing, in which information is thinnest and where the consequences of design errors are most serious.

What sort of studies are likely to reveal most? I suggest that when an office moves from one building to another, not such an uncommon happening after all, an ideal opportunity occurs for the study of the relation of organizational and behavioral variables to the environment. The building obviously changes; organizational changes may or may not be carried out simultaneously. But whatever happens, significant social changes or non-changes are certain, and it may be possible to trace their courses.

Clearly, the effect of new buildings or different social circumstances on the organization may be measured by such indices as productivity, increased or decreased communications, lengthening or shortening of distances traveled. The effects on behavior of building or organization variables may be indicated by absenteeism, sociometric change, unpunctuality, rate of depreciation of equipment, neglect of facilities provided or accretion of unwanted objects. There are obviously many more such signs. However, it is only scientific curiosity that will be able to transmute what would otherwise seem meaningless phenomena into real signs, real indices of what is really happening underneath the bland surface of photographs of office buildings in architectural magazines. There ought to be a law making such studies compulsory!

Another, easier course of action is simply to observe people at work. Of course, to observe acutely is never "easy" and I am suggesting observation comparable in acuteness to Goffman's studies of behavior in public places. Again the theoretical framework of organizational, behavioral and environmental variables is fundamental to such research.

Recently I have spent a little time comparing the workplaces of bank officers and lawyers, and I have found this a very rewarding task, because in each case rather similar work is done, but in very different physical surroundings. What is it about the banker's work or behavior that makes him sit in the open, near the public (in California at least), while the lawyer enjoys his private office? After a time and a few questions one begins to understand some of the very complex answers to this question. And one finds, too, that variables which seemed trivial have a disproportionately gross effect on the physical layout, while others which you would think would be dominant are subservient. I wish more of this work were done as a matter of course and recorded for the general good. In time it may be that such humble deductive observations will provide data which will be the basis for new hypotheses to be tested with sophisticated research techniques.

One of the great drawbacks of architectural research is that buildings are expensive, heavy and for all practical purposes, eternal. This makes the development of simulation techniques particularly interesting. Test offices *have* been used in Britain and Sweden. However, it may not be long before entire building environments can be simulated by electronic means. Craik[23] has a very interesting discussion of this whole approach.

To sum up, designers must demand applied research that is useful, that is not too difficult or expensive, and that is conducted within the framework of a model of relationships between job, worker and building. We need to know more facts.

I have done more than simply discuss social conditions in office buildings. Had I stuck to my brief, I might have provided one or two sociologcal explanations, or even given you some scattered clues about how to increase productivity by, for example, painting walls a certain color. However, I wanted to do more than that: to show the vital necessity for organizational and social research, and to stress that office buildings exist only to accommodate organization and behavior and to suggest a way of redesigning design to make full use, for the first time, of our knowledge of men at work.

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Panel Discussion: The Office Building

MODERATOR: (Philip Will Jr., FAIA; The Perkins & Will Partnership, Chicago): Is there an order of factors which cause obsolescence—waste, if you like, in office buildings?

SHELDON FOX AIA (Kahn & Jacobs, Architects, New York): I think that when you talk about obsolescence in the context of office buildings, they're getting more sophisticated. Year ago, the speculative builder was interested in getting the building built, getting his return, and possibly getting rid of the building. Today, he regards it as an investment over a period of quite a few years. He is going to live with that building, and the wants it built so that it has value for him five, 10 or 15 years from now. There is less and less obsolescence built into these buildings—investors are trying to look toward the future.

WILL: There was a statement made in the program for this conference which suggests that there is a lack of a spirit of cooperation within the industry; that the spirit is one of competition, and that people who have special knowledge use it as a bargaining advantage. Speaking for myself, I would say that the exact opposite has been true in my own experience. Others, however, might disagree with me. Would anyone like to comment?

ALBERT LOCKETT AIA (Skidmore, Owings & Merrill, Chicago): I share your opinion—I cannot agree with the statement that the industry does not cooperate.

WILL: I know that personally, we would never refuse information to a colleague, and I am sure that a spirit of cooperation must exist in other areas besides the architectural profession.

Restructuring the Industry

One thing which I think interests all of us is the shape of the industry as it may develop in the years ahead. I was particularly interested in Mr. White's closing comments, in which he spoke of the new relationship between the Ogden Corporation and our architectural colleague, Charles Luckman. There seemed to be a suggestion that this may be the wave of the future, and perhaps rather a small beginning of the restructuring of the building industry for the tremendous task that faces us, and the assumption that by the end of the war in Vietnam, means may be at hand, and the climate of public and governmental opinion may be such as to bring this about. Mr. White, would you care to extend your statements? I thought they were most interesting and very appropriate.

JOSEPH C. WHITE: I believe the situation is that we are going to be facing such fantastic needs that the ingenuity that has characterized American business over the years is going to make itself felt some way or another in the building industry. I think it is very difficult to predict exactly how this is going to take place, because the experiments which have been conducted up till now have not been entirely successful; the concept is new, it has to involve industry in a much more comprehensive way than ever before. It does involve the use of systems analysis, I feel sure. But of course systems analysis may be a bit of a mystique. So it's very difficult for me to predict exactly how this is going to happen. But obviously it has to happen—when, for example, in 1967, the average price increase of all commodities in the United States was 4%—but the price of housing went up 10%. I think we all know that the cost of construction is going up at a much faster rate than the economy, and that one of these days, something is going to have to give.

The number of apprentices entering the building trades is a fraction of the number required if we are to continue on the same basis on which we build today. So obviously, something has to happen.

As for my reference to the Luckman-Ogden merger, I would like to hear a few comments on that.

RICHARD J. OLDS (Vice-president, George A. Fuller Construction Co., New York): Historically, we have had two kinds of design and construction practices. We have had what is known in our business as the "package" firm; the firm which undertakes the architectural design of the building and then handles construction for the client, and the traditional practice of individual architect and individual builder.

And it seems to me that history has proven, despite the large size of some of the package builders, that the practice of separating design and construction services —whether for industrial, commercial, institutional or any other type of buildings—has produced better buildings more efficiently than the package approach.

I think one of the problems of the construction industry is that it suffers from very few changes of methodology over the years. To be honest, the only new practices which have come along in our business are the use of large cranes, hammerheads, and the palletizing of materials. But we still lay brick the same way; we follow the same construction practices which have been followed since the very earliest times.

And of course the problem which you mentioned—the lack of an apprenticeship program of any sizable scope—is another factor.

Therefore, without wishing to seem argumentative, I don't think that any large corporation can achieve the results that individual architects and contractors achieve, working in concert with the manufacturer.

What we are really talking about is, how do you increase your productivity to offset the rising cost of materials? I am afraid that the other approach which is suggested by the large corporation is going to result in closed specifications, and in freezing out the type of competition which is healthy for the construction business.

WHITE: I think that what I am talking about is considerably different from the way most of us look at the construction business today. Perhaps we need to look at buildings as something other than buildings—to take the approach taken by the large airframe manufacturers. They certainly know how to make airplanes which is a pretty complicated process—buildings aren't nearly as complicated!

I think that is probably the kind of thing that's going to happen—not necessarily that the construction industry will be taken over by aircraft manufacturers, but that the really large corporations are going to develop ways to meeting needs, to discover that the market is there, and that it is cohesive enough for them to get involved and to make a profit. The need is there, and I am sure that American industry has the ingenuity needed to solve the problem.

WILL: What you are asking us to do is jump 500 years in a short time. In support of Mr. Olds—there was an article recently which illustrated the very point he made. The article was illustrated with the reproductions of medieval prints showing the construction of Gothic cathedrals, and with photographs showing construction in America in the 1960s. And the only thing that had changed in the intervening 500 years was the style of the workmen's hats!

The Enriched Mix

QUESTION: I would like to ask why office buildings are not stacked, one on top of another? Say you have two or three companies, none of which can afford to develop the site to its fullest potential—why not, with express elevators and sky-lobbies, develop a stacking?

PETER E. PATTISON: I'll have to admit a bias, since I represent an investment builder which develops real-estate—therefore condominium occupancy holds no allure for us.

But aside from that, I see no particular advantages. The efficiency of large office buildings now come in the management of the large common areas run for the benefit of all, and I think you would derive very little benefit from condominium arrangements, other than that of independent ownership, for whatever that's worth.

RICHARD MYRICK (Project Manager, Performance Research Inc., Washington, D. C.): This suggestion relates a little to Jane Jacobs' thinking of the "enriched mix"—"mix" referring to a number of diverse activities going on in an area. As you know, New York's Wall Street at night is pretty dead. The idea of an enriched mix would have a large number of diverse activities going on, and would lend a sort of vibrancy or life to the place almost on a 24-hour basis, rather than having all office-buildings or work activity take place in one part of the city, all residences in another and stores in a third. In that light, the idea of stacking is interesting.

QUESTION: One of the difficulties encountered in designing a mixed-used facility is the zoning problems. Bertrand Goldberg found this to be true when he was designing Chicago's Marina City. What about other cities—New York, for instance?

JOHN T. O'NEILL (Commissioner, Department of Buildings, New York): By and large, there are three types of zoning—residential, commercial and manufacturing. You can't have either of the latter two in the first, but you *can* have some of the first in commercial areas. I don't see that to be a paramount problem. As you know, zoning isn't sacrosanct. We have recently been doing a lot of thinking about redevelopment of such areas as Bedford-Stuyvesant and Brownsville, and in Harlem to a lesser degree, neighborhoods which have been burned out, some for the second or third time. It seems to me that a mixed-occupancy development, with stores on the street level, and a school above, office-space above that, and apartments above that, would enable us to open up a lot of this area and provide outdoor space for people so they wouldn't have to sit out on the steps.

We do have one problem, of course, with zoning and building codes, and that is that any high-hazard uses have to be quite thoroughly insulated. I would think they should be on the ground floor and be built in such a way that they would be perfectly safe. But our zoning in New York at present, in my opinion, is very much oriented toward Manhattan which has not had all the problems which have beset the other boroughs. I think it should be possible to accommodate the various mixes and uses that we want.

AUDIENCE COMMENT: I think one could say that the real designers of our cities are not the architects and engineers, the planners, but rather, the lawyers and politicians and—forgive me, the bureaucrats—they set down the rules and regulations and thus produce the status quo which is colloquially defined as "the mess we is in."

As long as we have zoning which says "You can live only here and you can work only there, and you can play golf only over there," you've got transportation problems. People have to move from place to place, and that fills up the roads, and so on. I would say that most of our zoning ordinances are pretty silly.

Performance, Systems and The Office Building

Authors of the preceding papers have explored the problems inherent in office-building design and construction from the standpoint of the architect, the speculative builder, the user, the manufacturer and the Federal government. (Papers representing other viewpoints will be published in subsequent issues of BUILDING RESEARCH.)

It seems fitting that the Federal government, as the nation's largest consumer of office space, should assume a leading role in the application of building research to the office building.

The National Bureau of Standards Institute for Applied Technology has accepted the challenge, and is currently at work on a project which will hopefully result in the application of the concepts of building systems and performance criteria to the office building situation. The client for the first pass is GSA's Public Building Service, and the name of the game is enlisting industry cooperation.

The American Institute of Architects, through its Committee on Building Industry Coordination, recently sponsored a conference on the NBS/PBS project. Robert W. Blake, Michael Brill and Thomas Ware of the NBS-IAT staff were present to brief participants on the project, and to field questions raised by their predominantly professional audience. For this article, we have tried to select not only those questions which were most provocative, but also those which most typically reflected the concerns of the building industry over the emergence of systems—and performance-oriented design.

A discussion with Michael Brill and Robert W. Blake, Building Research Division, National Bureau of Standards

ROBERT W. BLAKE: Construction industry leaders are very much concerned about applied research. This is a recent concern; I think it is fair to state that it reflects a dramatic change in the climate of opinion in, perhaps, the last 18 months. We at the National Bureau of Standards Institute for Applied Technology share this concern, obviously.

We felt that it might be a very useful exercise to look at a building program in terms of *performance* as a basis for procurement. In other words, we might wish to procure buildings, or parts of buildings, on the basis of what a building should do for the owner and the user of the facility.

We are going to have to grapple right now with a definition of the word "system," which is one of the most fashionable words in Washington, and everywhere else, just now. In working out our definitions, we went back to the very apostles of the systems approach, our friends at NASA and the Department of Defense, and asked them, "Just exactly what do you mean by 'space system' or 'weapons system'?" Our definition is based on that used by the DOD Institute for Defense Analysis.

First we must differentiate between what we mean by a *building system* and what we mean by the *systems approach* or *systems engineering*. We believe that the building system is an aggregation of equipment, operating personnel, maintenance procedures and spare-parts supply. All of these things operate in conjunction to perform some desired function.

The building system, as we use the term, has a *thing* attached to it, a physical wall or a piece of equipment. However, we cannot look at the thing alone as a piece of hardware; we also have to look at the energy flowing to it, people operating it, spare parts to keep it going when (not if) it breaks down.

In contrast, there is the systems approach, which we define as a *method* or an *approach to solving problems*.

The first element of the systems approach is well known to all of us. We have been using it for years. It is merely a matter of breaking down a problem or a process into its component parts, with a definition of numbered relationships within and between the parts. Then it is possible to build up the existing or newly-devised parts into alternative solutions. We can then select the most attractive solution, as we understand it, at this point in the process. Then we construct and then we use.

If there is anything new, it is the notion of devising a model before construction—a model in which we can pre-evaluate the ability of a proposed solution to perform the desired function, and compare the results with the postulated success criteria which we hopefully set up originally.

Let's take heating, ventilating and air-conditioning. There are computerized models available on the market, which provide input for light loads in terms of heat-gain and loss. Using such a model, it is possible to predict with a high degree of accuracy the performance of an HVAC system before it is built. Energy requirements to run the system can also be predicted, using the same model.

Now, after that momentary digression, to return to our performance project: We have been fortunate in our association with the GSA's Public Building Service. Under PBS management, we have the entire spectrum of the building process, from the determination of requirements to the fiscal programming of the building through the Congress. PBS causes the building to be designed and offered on the market for bids. The building is completed and turned back into PBS's inventory for use by a captive tenant—a Federal agency.

So we have a critically-important feature which makes this a useful test-bed in that there is an opportunity for validation feedback. PBS keeps in touch with the tenant-users, and has an opportunity to reach into the experience of the Public Buildings Service itself, with measures of performance which are hopefully responsive to the needs of people. These then feed back into the modeling process.

We are only able, technologically, to cope with the office-space part of the building, not the core or elevators or closets. Neither are we attempting to determine performance specifications for the skin of the building. Thus we are talking essentially about a floor/ceiling sandwich which contains structure, lighting, heating, cooling and ventilating equipment.

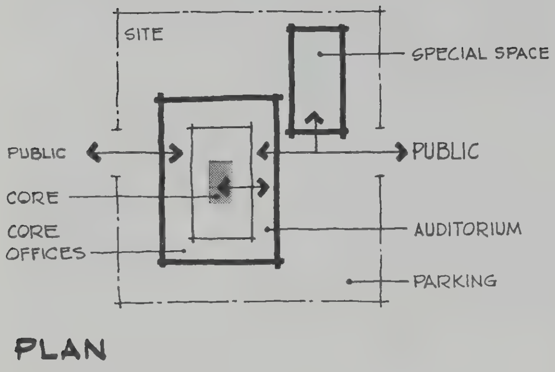
In terms of cost, we have had to work with the situation as it now exists, because there is no other referrant. When we say that PBS has built and can build buildings at about $22 per square foot, that is gross dollars divided by gross square feet for the office-space portion of the building. We have targeted the floor/ceiling sandwich at 40 per cent of that. We have an idea that it costs, on the average, around $8.80 per square foot.

We have no exquisite measurements of certain attributes. We would be pretentious if we claimed to know, for instance, exactly what the acoustical performance is. We know that we are not satisfied with acoustical performance at present. For instance, the human voice is clearly audible between offices in many existing Federal buildings. Generally, the performance we are talking about is the ability to improve the HVAC system, illuminating system, acoustical performance, health and safety, durability and other aspects of the building. Performance should be increased, but the cost should not be more than the $8.80 which it is at present. We think there is a good opportunity to deliver that result, although it is not easy to achieve.

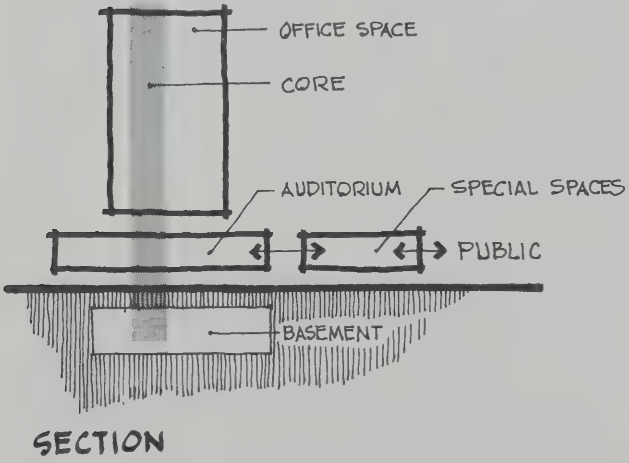
Performance Defined

MICHAEL BRILL: I'd like to clarify what we mean when we talk about performance specifications. We don't build schools because we want to build schools; it happens to be our way of getting education transmitted from one generation to another. If we could somehow do it without school buildings, perhaps we might. As it stands now, we don't have the magic machines or the telepathy to transmit the information.

The educational system is a whole set of things—teachers, buildings, school buses, a financial structure and a legal structure—employed to solve a particular problem. The whole idea of systems performance simply says, "I have a goal which I want to achieve." There might be alternative ways of achieving the goal. Stated in terms of performance standards, we might say, "We are interested in transmitting knowledge," without regard to the materials we use, or the configurations or relationships between them.



Schematic plan and section, showing major elements of office building with their primary relationships and linkages to the site. Elements are perimeter structure, core, core corridor, special space (auditoriums, courts etc.) and gross office space.



All of this implies a user, someone upon whom the system operates. When we talk about Federal buildings, we have a lot of different kinds of users in mind. Secretaries use space differently from executives, who use it differently from the mailroom personnel, who use it differently from the public who come in to fight about dog-licenses.

These different users have different requirements in terms of internal building transportation, communications systems, etc. They also have a lot of similar requirements—heating or cooling, lighting, acoustical treatment—although these will vary under different situations.

"Performance" and "systems" are and must be aimed at measuring user-needs, so we can harness the incredible capability of the building professionals to achieve those goals, perhaps in innovative ways, or through a re-evaluation of existing ways.

Our office-building user is a person in space doing a task. He has certain requirements. He does not need lighting fixtures; he does need light. His basic needs in terms of sound vary. For example, a lecture-hall with a vaulted ceiling allows sound to travel so that, hopefully, those in the back of the room can hear. In other situations sound should be contained or compressed.

We don't necessarily need partitions; we do need barriers. Sometimes they are acoustical barriers, and sometimes they should be visual as well. We don't need structural systems; we need stability and strength of materials. We need to provide for the health and safety of the users. The space must have the ability to be manipulated in various ways, so it can accommodate to changing needs. And it must be maintainable. It has to have esthetic values of some sort.

Finally, there is the thing we call "interface." The various components of the system must be compatible with each other, not only technologically but visually.

Thus it would be possible to represent the things we want out of our system components as a table or matrix. Across the top is a list of the hardware of office space which generates or controls these attributes. On the other axis, we can array the effects we want, as users, and the limits or tolerances we can allow.

Any performance statement has three parts. There is the "requirement," a formalized statement of *what* is wanted; a number or quantifier attached to it to define *how much* is wanted, or "criteria," and finally a "test" to insure that we are getting what is wanted.

There is a process by which hardware comes into being, which in itself places constraints on the hardware design. Suppose, hypothetically, we discovered that our planning would require 10-foot-wide elements, 40 feet long. We would shortly discover that these 10-by-40-foot elements would be impossible to ship by road; thus the process of transporting the hardware would place a constraint on the building. We want everything in the building to be a response to the user. Therefore we might say, "What would have to be done, to make it possible to ship such elements?" But if it turned out to be too much of a problem, we would probably say, "Okay, forget it," and try something else.

Thus performance criteria and systems are not a magic process by which we examine user-needs and proceed to meet them. The work is being done in a real-world context.

Sometimes user requirements become somewhat subjective and difficult to quantify. The Federal office building is really part of a Federal information-processing system. All you do in an office is process information, whether with your mouth, with machines, or with files. If the government could process information without buildings, it might.

If you examined the cost of information processing over the 40-year life of a building, you would find that 92 per cent of the cost is the cost of people—salaries. Six per cent is the cost of maintenance. And only 2 per cent is the first cost of the building.

Value Added

The 92 per cent invested in salaries represents what economists call the "value added" in manufacturing. You take raw material and do something to it, and it comes out at the other end as a usable product. The "value added" is in the processing. Salaries, in this case, are a measure of how we think of value added.

There have been many studies pouring out which indicate that productivity is a direct function of a person's sense of well-being. You can have studies made to determine whether the photocopy machine should be 40 yards from the seecretary's desk, or six yards—but somehow her productivity seems more closely related to whether or not she has a mirror in her locker. Workers are terribly sensitive to management's interest in them.

If it is true that productivity correlates directly to well-being, and 92 per cent of the equation is the cost of people, it brings us back to performance. What do we have to do to increase the productivity of the total system? If it means that the first cost of the building goes from 2 per cent to 2.08 per cent, and the productivity goes up by a much larger amount, the implications for the owner or tenant should be obvious.

QUESTION: Please don't think I am being derogatory or facetious, but government, to my way of thinking, is about the only sort of client which can afford this type of experiment. If this plan does not work, the government is in a financial position simply to write it off the books—very difficult for an individual or a private corporation to do.

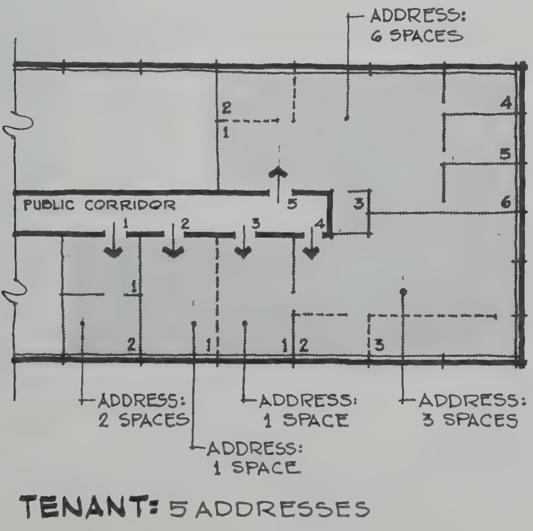
BLAKE: Perhaps you are right in saying that the government is the only client in a position to take this particular role. On the other hand, we would be complete charlatans if we were trying to lead a client down the road to a building which might not work. Performance clearly implies testing—a real, live, full-scale testing procedure. That which cannot be tested cannot be described in performance language.

QUESTION: Isn't it possible that, where there are potential conflicts between two of your performance criteria, you are going to have to assign preferences or priorities? You might, for example, have conflicts between acoustic requirements and a need to place utility lines in a partition, perhaps.

BRILL: We would be irresponsible if we were to establish criteria which literally could not be met. One of the reasons we have published a status report is that we are marketing, so to speak, an unfinished product. We have gotten statements back from representatives of industry, from architects, from engineers, from PBS itself, saying, "Wait a minute, you have overlooked a problem—" the relationship, say, between the acoustical quality of a component and telephone boxes back-to-back.

QUESTION: Are you going to take bids from industry on just a floor/ceiling sandwich, and then retain someone to design the sandwich into a building, or is it your proposal to get bids on a building?

BLAKE: What we are talking about is doing some pre-engineering and providing the project architect with a



"Tenant," as defined in NBS/PBS project, is an independently-operating organizational unit. "Space" relates to physical habitat; "address" is space accessible to a public corridor. Diagram shows tenant occupying 13 spaces, 5 addresses.

new kind of "erector set" of components which he will incorporate into his design.

BRILL: Industry and architects and engineers may be able, through the normal construction process, the process of building rather than the process of manufacturing, to achieve the performance we want. On the other end of the spectrum is the "magic erector set" which comes to the site in plastic bags—the bags are taken off and a few connections made, and there is the facility. We are not making any pre-evaluation as to the desirability of these alternatives. We don't care how it goes together, or who produces it, or what its shape is, so long as it does the job.

I should make one important amendment to that statement. One other thing it has to do is achieve at least a minimum level of esthetic acceptability. This is very difficult to talk about in performance terms, but it is a criterion which must be met.

QUESTION: Do you have any input from labor, as to what will be acceptable to the various trade jurisdictions?

BLAKE: We have been in touch with representatives of the AFL-CIO. Part of the bidding procedure, in fact, is to announce ahead of time to enable bidders to accommodate to a local labor situation.

QUESTION: Do you expect that manufacturers will come up with new components designed to meet your particular requirements or specifications, or may they use existing components which might meet these specifications? You are talking about a million square feet. This means they must do all the research and development and tooling up for three or four projects, which isn't very much. They might never get their investment back.

BRILL: You have mentioned two possible solutions; special components and traditional, existing methods. If both are a clear response to the performance specification, then either is acceptable.

Parallels with Other Systems

QUESTION: Is it possible, then, that your results might very well parallel those in the School Construction Systems Development project in California? Actually, after all the foundation-supported research, they came up with pretty much the same system that we had at our disposal before, as far as the components were concerned.

BRILL: I would take issue with the statement that the SCSD components were "what we already had" in all cases. But in terms of our project, I think we have to understand that we have purposely set the target-market low. There is no carrot dangled at the end of our string, in terms of the actual Federal market. The market which a manufacturer must assess is a function of the applicability of our specifications to commercial office space, of a particular quality level, out there in the real world. If his determination is that these are highly-specialized criteria, which seem to deal only with Federal office procedures, then he is obviously not going to commit research and development toward developing components which have only very limited use. Nobody gambles to that extent.

PBS buildings are on Federal land, and are exempt from zoning and code restrictions. If we were to design performance specifications based on that kind of freedom, the guaranteed Federal market would have to be immense in order to attract the research and development capability of industry. It would have to be far larger than it is—$22 million worth of building, of which only $9 million goes into the floor/ceiling sandwich. So we have specifically stated that all of the requirements, specifications and contract documents we develop must be commercially feasible; that is, applicable to the non-Federal market.

BLAKE: Mike Brill is an architect. As a construction engineer, let me see if I can respond to that a little differently.

You go out and look at the SCSD prototype building and at the schools which have been built. Where is the hardware? You don't see any hyperbolic curves, or any great plastic roofs suspended by God-knows-what. You may not see anything very unconventional. But looking back to the early 60s, the hypothesis was that SCSD could provide air-conditioned schools with flexible interiors in an environment which, at that time, for that cost, was *not* producing a flexible interior arrangement. Educators seemed to think that was what they wanted. It is the response of the hardware, whether newly-developed or existing, to user requirements that is important.

QUESTION: You might conceivably have a situation in which only one manufacturer meets your criteria. This would give you a closed-specification situation. How then do you control price?

BLAKE: Hopefully we will get more than one—a single bidder could be a disaster.

BRILL: Management constantly retains the right to say "Go/no-go." We have a lot of "go/no-go" points along the way. One could happen when prototype designs are submitted for testing, and none passes.

Another possibility would be that when they are submitted with prices, the one that passes the tests is far in excess of what PBS is willing to pay for buildings. No owner is forced to build. We are setting cost parameters, and this will be announced at the pre-bid conference. If the system comes in over the stipulated amount, it will not be responsive, and we will reject any and all bids.

QUESTION: I am a little troubled by all this. I have always believed that American industry is fully cognizant of what the needs of its customers are. I wonder what sort of breakdown of confidence in industry leads the Federal government to set up an organization such as yours, in order to try to define the problem for industry?

BLAKE: One of the jobs of the Federal government is to purchase buildings wisely. It would certainly behoove the Commissioner of the PBS, who procures about $200 million worth of office space a year, to conduct research, consider new approaches, and to make some tests of the viability of new ideas. I would answer you with another question: How can industry be responsive to the needs of Federal agencies who are tenants of buildings? Where can they get this background knowledge? That is one of the things we try to provide.

European Systems Cited

QUESTION: It seems to me there is another benefit to such a program. Once systems are developed, you can achieve your buildings in a much shorter time than with conventional methods. This has a dollar value to the owner, because the dollar investment will provide a benefit much sooner than with conventional construction.

But I am interested in learning whether or not you looked at some of the European systems for apartment buildings, rather than office buildings, and how your system might compare with them. Some now incorporate all of the items which are not included in your project, as well as those you are including.

BRILL: We have looked at the European systems. There is a very important distinction which must be made between European systems building and what we are trying to achieve.

The European systems, in general, start with the concept that better ways of procuring hardware can be developed by starting to enlarge and componentize, and that is one solution—for certain types of problems. In many cases those problems are quite different from our own. The whole relationship between government and the building industry is different in many European countries from ours in the U.S.

We are not designing hardware. That is up to the manufacturer, the fabricator, the general contractor. We are—we hope—taking a first stab at getting back to the user.

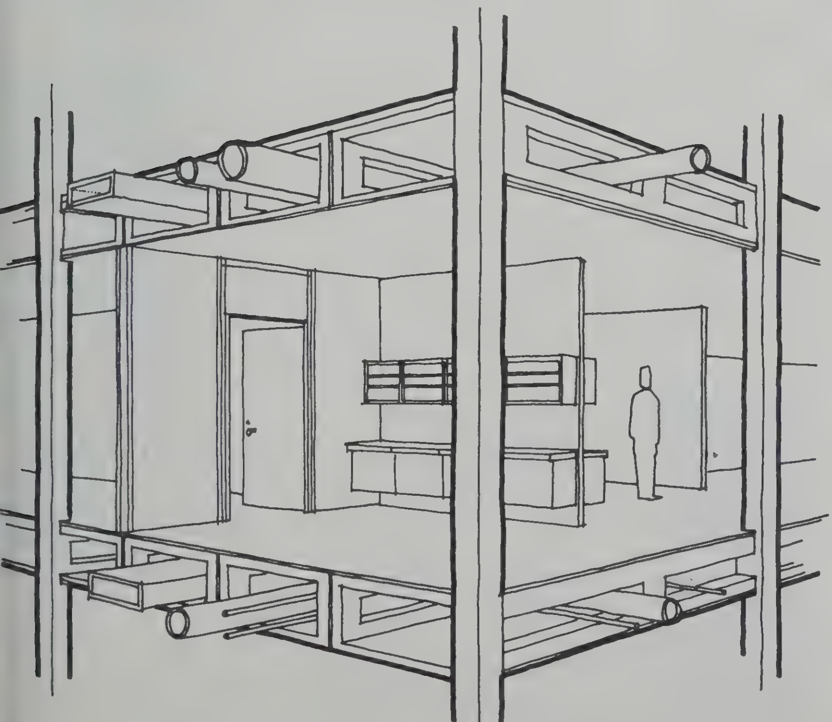
We would be totally remiss if we did not look at the European systems. But ours is a very different game, and one which I think is peculiarly suited to the spirit of America.

QUESTION: It seems to me that unless there is an exhaustive study of the psychology of the user, it is difficult to obtain performance criteria for the system. It also seems as though the user reacts more to hardware than to theoretical criteria.

In your model stage, how exhaustive is the study of psychology of the user? Where do you find the psychologically-normal user to bounce your studies off of? Going back to the well-known Hawthorne experiments dealing with the effect of lighting levels on employee performance, aren't you somewhat in danger of having the wrong criteria?

BRILL: We may have the wrong client to answer your question. PBS is the building arm of the government. They are the instrument which produces buildings that the other agencies occupy. The efficiency of the building is the concern of other agencies in terms of their own productivity. That is not to say that PBS is not concerned, but that may not be their prime concern.

We will, however, go as far as the present state of the art will take us. We have had psychological and anthro-



Project target-area is the floor/ceiling sandwich, which include service distribution and represents close to 40% of building cost. Core, core-corridor and perimeter structure are treated as interface conditions with which floor/ceiling sandwich must be compatible.

pological consultants working with us, trying to determine what we can say about people in a space.

We are going to be working with the National Institute of Mental Health to study these problems, and we hope to use the results as input to the next systems project, so that we will then have a much larger and denser piece of information upon which to make judgments.

QUESTION: Do you feel that what you are doing is really any different from what architects have been doing for years, as far as programming for needs is concerned?

BRILL: Yes, I think there is a difference. Every architect goes through a simplified and, in many cases, intuitive form of systems analysis and performance analysis on every design project. All this is done with a certain amount of training, a heaping amount of intuition and, frankly, a large hole in the data-bank from which we work. Few architects have the fee-structure to avail themselves of the kind of information which we and others are trying to develop. No formal feedback structure exists in the architectural profession.

Performance is an attempt to try to define exactly what we want out of this whole process, to model or simulate it so that we know the effects before we build, and finally, to make a formal procedure for getting information back into the next cycle of design.

Creating a Monster?

QUESTION: Aren't we in danger of creating a Goliath of corporations when we require one firm to furnish a floor/ceiling sandwich, made up of several components?

BLAKE: Definitely not. We are not asking for a *single* bid. We are asking for a *group* of bids in which each of the component manufacturers—ceiling, lighting, partitions and structure—sets a price for its bid and identifies the other manufacturers with whom they are compatible; that is, those with whose products their materials will go together in a certain way.

You don't need to have a monopoly organization made up of sub-organizations, so long as you have an overall dimensioning or modular system, such as that used in SCSD, which will insure that the various components—although from independent manufacturers—can be put together compatibly with a minimum of cutting, patching and fitting.

QUESTION: Where in the schedule does the architectural input begin? You have a building design phase, but where in this total five or six or 10-year period does the architect get involved, the private practitioner who has been hired to design the building?

BRILL: It is envisioned that the architect and other design professionals will become involved earlier than under the Public Buildings Service's traditional way of letting contracts, and that there is a back-and-forth kind of familiarization which obviously implies some re-evaluation, some re-examination of fee structure and so forth, since the responsibilities are in a sense altered.

QUESTION: How *are* the services of the professionals altered by following this concept? Won't the architect and engineers have less to do because building components are pre-selected? If, for example, the air-conditioning is already designed by the manufacturers, what does the engineer have to do?

BLAKE: Hopefully, with some pre-engineering and a good deal of work completed in the form of shop drawings, we should be able to free up a lot of professional time which can be put to more creative use. Personally, I have never enjoyed checking shop drawings.

Fixing the Responsibility

QUESTION: What about guarantees? The conventional system requires that the contractor accept the responsibility for guaranteeing, usually for a year, the performance of all the materials and equipment placed in the building under his contract. What about the situation in which he is literally handed a system which he must use?

BLAKE: Our preliminary thought is that there will be no separation of responsibility from the manufacturer, and that the general contractor would not be held responsible for the item manufactured and installed by others. The process assumes that those things developed by a manufacturer will be installed by the manufacturer.

QUESTION: In the typical building process, the architect and engineer are thought of as agents of the owner, and are responsible for the protection of his interest during the construction process. Obviously, this relationship is changed under the arrangement you are describing. How will it work?

BRILL: True, the professionals are responsible for determining whether or not the owner is getting what he is paying for. They can't guarantee that he will get it, but they can advise him as to whether he is getting it. Actually, I think our proposed system strengthens the professional position, by demanding performance. In the conventional system, all we can say to the owner is that he is getting a 10-inch brick cavity wall with galvanized wire ties, or whatever has been specified. We cannot guarantee that it will be watertight or airtight or stable.

But with performance specifications, we don't really care what the wall is, so long as it assures us of watertightness, or whatever other attributes the user requires. So I think, in a sense, it really strengthens our capability of assuring that what we design and have built *will* perform.

QUESTION: Since the manufacturers are going to design the structural system, it seems to me that we have a potential problem in the private sector in order to comply with state registration laws, in that we have a manufacturer designing a structural system. Is this a problem?

BLAKE: This means that the manufacturer will know where the building is going to be built, and will have to abide by the requirements—including registration laws —of that locale.

Cooperation with HUD

QUESTION: Has there been any attempt to coordinate this effort with other Federal programs which deal with building construction—the Model Cities program, for instance?

BRILL: Yes, we are now developing, with the Department of Housing and Urban Development, performance concepts for housing. We have research money, and we will have more. How can we best use this money to make the greatest impact, not on houses as dwelling units but on housing in the larger context, including the neighborhood, the community and all the forces which act upon it? If we are selling anything, it isn't hardware; it is a kind of intellectual approach to problem-solving, which we believe is as applicable to that area as to a PBS office-building.

QUESTION: How will this affect the matter of architects' liability for errors and omissions? If all indications are that a wall should perform to certain specifications, regardless of construction, and it does not perform, the architect is still wide open.

BRILL: Recent unfortunate trends have made the architect more and more responsible for things which happen before, during and after the construction process, some of which are entirely outside his ability to control. However, I think that with the backup of the performance concept, where the owner is buying performance, not *things*, it should be easier to assign responsibility. I am frankly not sure to whom. But I am sure that the professionals are in a stronger position when they say they are not getting the *performance* specified in the construction documents. This is testable.

QUESTION: What is the ultimate purpose of this system? It seems to me that it either ought to save money, or to produce a better building for the same money, or give more esthetically-pleasing buildings.

BRILL: In 30 years, we need 68 million additional housing units. This doesn't even take into account the schools, hospitals, factories, universities, office buildings, hotels, airports etc. which will be needed to support that population.

Because of the rate of urbanization and technological complexity, we are not going to be able to house all of the people and things which will have to be housed, unless there is some restructuring of the ways we build. And this idea is, I believe, one of several competing ideas for ways to achieve the next measure of adequacy.

QUESTION: We have all joked somewhat nervously about the possibility that the computer may one day replace the design professional. Doesn't the possibility of a whole array of pre-engineered components tend to hasten the day when the designer might indeed be dealt out of the game, with a resultant loss in human and esthetic values?

BLAKE: I'll have to answer by asking you whether you would take the word of an accountant who wouldn't use an adding-machine? A computer is one of the designer's tools. So far as esthetic values are concerned, keep in mind that this system does not include exterior wall design, or many other components which help determine the esthetics of the building.

BRILL: It is inconceivable to me that the systems approach will, to any large extent, alter the design or the whole method of procuring "high-hierarchy" buildings —churches, certain kinds of schools, single-family residences—all the things which are by their very nature non-standard, special to the community and to society.

I think that systems offers a way of controlling, much more than we can at present, all of the buildings which make up the bulk—office buildings, warehouses, certain types of industrial buildings, gas stations, etc.

We are talking about what Bill Allen, head of the British Building Research Station, calls "the great American trick of expanding the market." To take the British experience as an example—10 years ago, 45 per cent of all buildings passed through the hands of architects in Great Britain. Now, they have had a tremendous trend toward performance, systems, research. And at present, *75 per cent* of the built environment goes through the hands of the design professions—far in excess of the percentage there 10 years ago, and far in excess of what happens over here now.

By the time we get hold of a housing project, it has been designed—by the budget and amount of return required; by zoning considerations; by other constraints. So to argue that design is being taken out of your hands by the use of a different kind of element than those which now show up in building-product catalogs, seems to be quite a serious mistake.

All we are trying to do is establish the basis on which elements can be designed, in such a way that they are already predisposed to solving problems or giving certain required performance.

Michael Brill is an architect with the Building Research Division, National Bureau of Standards. He is on leave from the New York architectural firm of Westermann and Miller, and from the faculty of Pratt Institute.

Robert W. Blake is a construction engineer with NBS. He has had previous experience as a general superintendent of construction and as a general contractor.

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Report of AISI research on paintability of galvanized steel; corrosion resistance of metallized coatings. 48 p., 1963, $6.00

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Covers prefinishing of metallic and nonmetallic subtrates and cementitious materials; economics of prefinishing. 92 p., 1962, $6.00

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Report of workshop. Also covers effect of physical factors; problems and limitations of thin shell concrete roofs; materials for weatherproofing. 47 p., 1961, $5.00

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Methods of Building Cost Analysis (1002)
Techniques for economic analysis; case studies of annual cost, present worth, and nomograph computer methods; measuring area and volume to determine cost. 80 p., 1962, $8.00

Modern Masonry: Natural Stone and Clay Products (466)
Report of conference sponsored by Allied Masonry Council. Covers colors and textures; modular design; types of masonry walls and thermal performance; ceramic panels; research on stone, marble, granite, brick, and tile; costs and maintenance. 163 p., 1956, $4.50

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Specific applications of plastics for daylighting and electric lighting; materials available; light control; luminous ceilings; future uses. 99 p., 1958, $3.00

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Architectural criteria; installation and operation; materials and maintenance; hardware. 93 p., 1961, $6.00

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Effects of solar radiation on man; solar energy data applicable to building design; solar effects on architecture and building costs; selection of glass and shading; design of windows, skylights, and electric illumination; window design in Europe, especially Sweden. 174 p., 1963, $10.00

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3 Building Research

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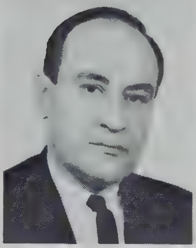
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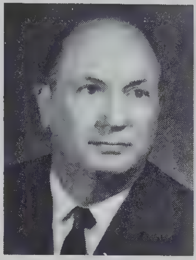
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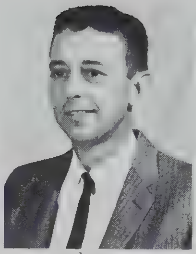
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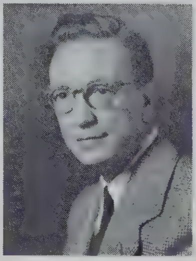
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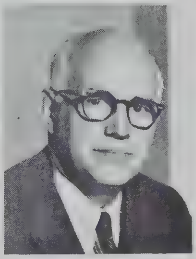
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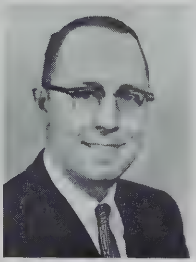
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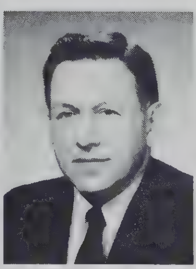
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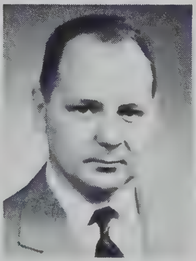
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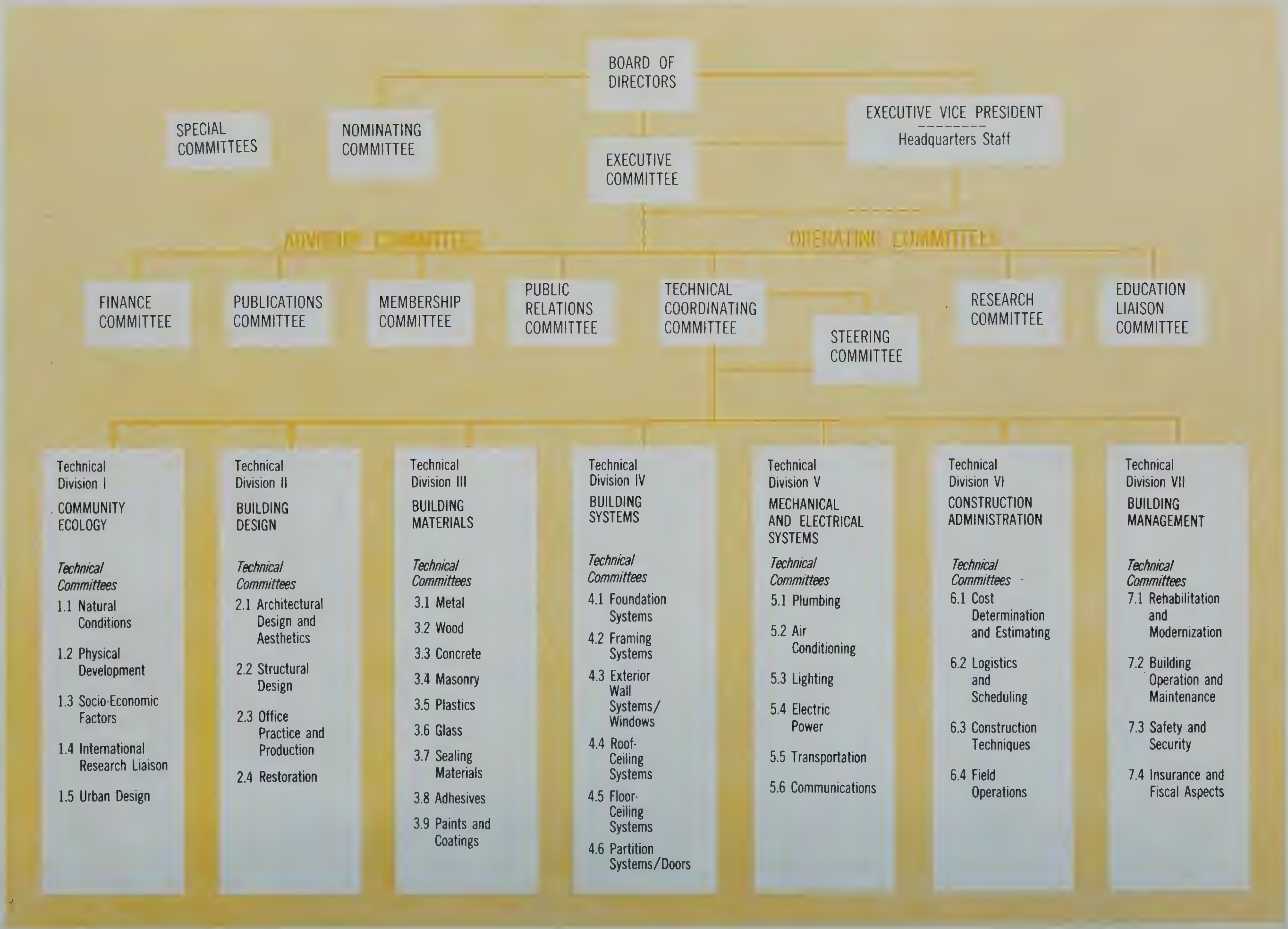

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Totally-Manufactured Building Modules:

THE CASE FOR INSTANT SPACE

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VOLUME 6, NUMBER 1
JANUARY/MARCH 1969

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Building Research is published quarterly by the BRAB Building Research Institute, National Research Council, 2101 Constitution Ave., N.W., Washington, D. C. 20418. BRI members receive *Building Research* as a membership service. Subscription rates to non-members: $35 annually; $9.00, single copy. Special rate for college, university and public libraries; $20 annually. All subscriptions payable in advance in US funds. No discounts. Additional subscriptions or copies to BRI members or employees of member-organizations, $12 annually; $3.50 single copy.
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ATTENTION

Due to circumstances beyond control, there was no October/December, 1968 Volume 5, Number 4 issue of *Building Research*.

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building science news

BRI Conference to Examine "New Towns"

The Building Research Institute's 1969 Spring Conference will take a critical look at America's New Towns, according to chairman Robert M. Engelbrecht.

The conference, scheduled for April 29-30 and May 1 at the Sheraton-Chicago Motor Hotel, Chicago, Ill., will examine the New Town concept from the standpoints of land-use, financing and social concerns, as well as design and construction.

New Towns for leisure, recreation or retirement; industrial New Towns, and center-city redevelopment areas will be discussed in addition to such recently-created communities as Columbia, Md. and Reston, Va.

Conference registration fee for BRI members is $35; for non-members, $50. Additional program information and registration forms are available from the BRAB Building Research Institute, 2101 Constitution Ave., N.W., Washington, D. C. 20418.

Edward T. Schreiber To Head BRI

J. Donald Rollins, Chairman of the Building Research Advisory Board has appointed Edward T. Schreiber as Chairman of the BRI Operating Committee. The Operating Committee is responsible for the general operation of the Building Research Institute.

Schreiber is President of Construction Consultants, Inc., Detroit, Michigan and a former board member of the old BRI.

Construction Standards Meeting Held

"Building Construction Standards" was the theme of a Chicago seminar held March 17-18, under the joint sponsorship of the American Society for Testing and Materials; BRI; the Construction Specifications Institute, and the ASTM Chicago District Council.

Speakers included Robert W. Blake of the Building Research Division, National Bureau of Standards; BRAB Vice Chairman John P. Gnaedinger, President of Soil Testing Services, Inc.; Ross W. Pursifull, AIA, an Associate in the firm of Smith, Hinchman & Grylls, Inc. and a member of BRI, among others.

University Construction Fund Cited

New York's State University Construction Fund, established by Gov. Nelson Rockefeller in 1962 to coordinate planning design and construction of physical facilities on the university system's 29 campuses, will receive the 1969 American Institute of Architects Citation of an Organization.

The Fund, an institutional member of BRI, handles over $150 million worth of design and construction annually, and currently has under design or construction 152 projects, estimated at $252.2 million, due to be completed in 1969.

AIA's Citation reads, in part, "The State University Construction Fund had judiciously selected from the finest architectural talent in the United States, the architects to design and develop the campuses of the State University of New York. In its quest for excellence, it did not limit itself only to architects from the state of New York. This broadminded procedure has produced a distinctive and consistent high quality of architectural design throughout the entire system of the State University of New York which is commendable."

Koch Honored by AIA

Architect Carl Koch, author of "Component Design for the Urban Environment," which appears in this issue, has been selected to receive AIA's 1969 Industrial Arts Medal. Koch was cited for "untiring work to incorporate prefabricated building materials into his designs with variety and imagination. He has worked closely with corporate clients, endeavoring to meet the needs of society in urban housing, and has demonstrated a knowledgeable grasp of one of our most pressing problems."

ENR Names Ehrenkrantz "Man of the Year"

Architect Ezra Ehrenkrantz, president of California's Building Systems Development, Inc., has been named Construction Man of the Year by *Engineering News-Record* magazine.

Ehrenkrantz, whose SCSD system of compatible, prefabricated building components was developed for 13 California school districts, has also been instrumental in evolving component systems for school projects in Florida and in Pittsburgh, Pa.; residence and academic buildings for the Universities of Indiana and California; medical facilities, and in studies for the Department of Housing and Urban Development In-City program for low-cost housing.

The ENR award cites Ehrenkrantz as the "principal advocate of systems building whose ideals for better schools are finding wide application across the nation."

Crouch Receives IES Award

Cazamer L. Crouch, research director of the Illuminating Engineering Research Institute, was awarded the Illuminating Engineering Society's 1968 Gold Medal.

The highest honor in the lighting profession, the IES Gold Medal award is made "for the purpose of giving recognition to meritorious achievement which has conspicuously furthered the profession, art or knowledge of illuminating engineering."

Mr. Crouch, a Fellow of the IES, received the award for outstanding leadership in initiating and guiding research in light and vision, and in the organization and guidance of the technical activities of the Illuminating Engineering Society.

BRI Officers Serve On ERIC Committee

Dr. Alan Green, Secretary of Educational Facilities Laboratories, Inc. and a member of BRI's Operating Committee; Robert M. Dillon, BRAB Executive Director, and Ben H. Evans, BRI Executive Secretary, have been designated members of an advisory committee for the Educational Research Information Center/Clearinghouse on Educational Facilities.

ERIC/CEF, established at Madison, Wisc. in 1967 under a U.S. Office of Education contract, collects, indexes and abstracts approximately 1,000 documents per month, all relating to the subject of educational facilities research. Indexing information and abstracts are published in the ERIC/CEF monthly journal, *Research in Education.* The journal also contains information concerning all new project awards made by the USOE Bureau of Research.

Research in Education is available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402; annual subscription rates are $11 (domestic) and 13.75 (foreign), single copies, $1.

BRI Cosponsors Glass Seminar

"Durability of Insulating Glass" was the subject of a November seminar at the National Bureau of Standards, Gaithersburg, Md., under the joint sponsorship of the Bureau, the Building Research Institute, the American Society for Testing and Materials and the Construction Specifications Institute.

The two-day meeting was coordinated by BRI Operating Committee member Robert W. McKinley, of PPG Industries, Inc. and by H. E. Robinson of the NBS Building Research Division. Mr. McKinley represented ASTM Committee E-6. Purpose of the conference was to bring together people concerned with the design, manufacture, testing, specification, purchase, installation and maintenance of windows, in order to exchange information which could lead to better insulating-glass performance.

Representatives of building research institutes in Canada and Norway appeared on the program along with representatives of U.S. industry and NBS.

HEW Contract Awarded for Concrete Studies

The American Concrete Institute, Portland Cement Association and the National Ready-Mixed Concrete Association received a contract late in 1968 from the Department of Health, Education and Welfare, to develop and evaluate a new curriculum in concrete technology.

James D. Piper, senior vice-president of PCA and a member of the BRI Operating Committee, will serve as principal investigator.

The purpose of the four-year program is to develop course content and teaching materials to train technicians for the concrete industries. Where no training now exists, the program will provide a curriculum of vocational education, which is anticipated to be of value in broadening employment opportunities for nonacademic students and relieving critical manpower shortages in the cement and concrete industries.

Course materials will be adapted for use in in-service job training programs, upgrading of present job skills and other adult education programs.

New curriculum materials will be produced in the first phase of the three-phase program. Phase II will consist of a two-year field evaluation at selected vocational schools and junior colleges, with the final phase devoted to revision and adaptation of the training materials to a wide variety of vocational education programs.

Computer-Aided Urban Design Course Offered

A short course in computer usage for architects and urban designers will be offered by the Massachusetts Institute of Technology, June 17-27.

Participants will first be taught a programming language and asked to undertake simple but relevant problem-solving tasks; the class will then concentrate on interactive systems wherein architect and machine are mutually designing, interrupting and evolving.

Students will work with an IBM Model 67 computer. The course will be presented by Professors Nicholas Negroponte and Leon Groisser of the MIT Department of Architecture.

For further information, write: Director of Summer Sessions, Room E19-356, MIT, Cambridge, Mass. 02139.

Professional Development Seminars Scheduled

The American Institute of Architects will sponsor a series of seminars on topics of interest to design professionals, in four cities across the country. The seminars, each of which will rotate "round robin" between New York, Chicago, Atlanta and Los Angeles, will cover the architect and the law; specifications; project finance and loan development, and architectural programming.

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calendar

BRI MEETINGS

April 20-30, May 1—Spring Conference, "New Towns: Frontiers or Failures?" Sheraton-Chicago Motor Hotel, Chicago, Ill.

April 29—BRI Operating Committee, Sheraton-Chicago.

OTHER MEETINGS

March 17-18—Building Construction Standards Seminar, Sheraton-Chicago.

March 30-April 4—Annual Convention, American Concrete Institute, Palmer House, Chicago, Ill.

March 31-April 1—American Plywood Association, Regency Hyatt House, Atlanta, Ga.

May 4-7—Annual Convention, National Association of Architectural Metal Manufacturers, Mountain Shadows Hotel, Scottsdale, Ariz.

May 12-16—Annual Meeting, National Fire Protection Association, Americana Hotel, New York, N. Y.

May 18-22—Land Use Symposium, "Land: Recreation and Leisure," Urban Land Institute, Doral Country Club and Hotel, Miami, Fla.

June 15-18—Annual Convention, National Plumbing-Heating-Cooling Contractors, Americana Hotel, Bal Harbour, Fla.

June 22-26—Annual Convention, American Institute of Architects, Palmer House, Chicago, Ill.

June 22-27—Annual Meeting, American Society for Testing and Materials, Atlantic City, N. J.

July 6-10—Annual Meeting, Forest Products Research Society, Sheraton-Palace Hotel, San Francisco, Calif.

re-searching

BY BENJAMIN H. EVANS, AIA, Executive Secretary

The New Look • A lot of water has passed under the bridge these past few months. After considerable deliberation and examination of objectives, the Board of Directors of the old Building Research Institute, Inc., a nonprofit corporation in the District of Columbia, decided to recommend to the Institute membership that BRI be dissolved, that all BRI activities be combined with those of the Building Research Advisory Board and that all assets be transferred to the National Academy of Sciences.

At a special meeting of the membership on December 18, the Institute voted overwhelmingly in support of the Board's recommendation, and the Building Research Institute, Inc. went out of business as of midnight on December 31, 1968.

Created in its stead by the Building Research Advisory Board as of January 1, 1969, was the new BRAB Building Research Institute. The BRAB Associates program was also dissolved and all members in good standing of both the BRAB Associates program and BRI were invited to become, and were automatically considered, members of the new BRAB Building Research Institute. The combined membership is now approximately 650-strong.

The BRAB Building Research Institute functions within BRAB, which is a unit of the Division of Engineering of the National Research Council. The previous BRI Board of Directors has been supplanted by an Operating Committee to provide immediate direction and guidance for BRI activities. An internal policy and administrative committee, known as the Institute Affairs Committee, has been established by BRAB. Six members of the old BRI Board (the Executive Committee) have been appointed to the Building Research Advisory Board, with ex-president Gershon Meckler becoming a member of the Executive Committee of BRAB and Chairman of the Institute Affairs Committee. W. T. Kemp, a member of the BRAB Executive Committee and former chairman of the Board's Associates Affairs Committee, will be Vice-Chairman of the Institute Affairs Committee. Edward T. Schreiber, also one of those six, has been appointed as Chairman of the BRI Operating Committee, to head BRI activities. The remaining non-BRAB members of the old BRI Board and three BRAB Associates now have become the BRI Operating Committee.

The staffs of the two organizations have been combined under the direction of Robert M. Dillon, AIA, Executive Director of BRAB. I am now Executive Secretary of BRI and an Assistant Director of BRAB. My duties are still related primarily to functions of the Institute, but I will assist with special study projects and other activities of the Board.

Plans for the future of the BRAB Building Research Institute were under way even as the mechanics of combining the two organizations were being developed.

BRI will continue to carry out its mission as an interdisciplinary building community forum and information clearinghouse. Conferences will be held on both national and regional levels; BUILDING RESEARCH, the Journal of the BRAB Building Research Institute, will continue to be published and will be supplemented by newsletters and other publications as necessary. BRI will also continue its membership structure and technical committee activity, and welcomes the active participation of all its members in the vital work which has received new impetus from the Institute's re-association with BRAB and the Academy.

Launching of the new BRI program will take place at the Spring Conference, "New Towns: Frontiers or Failures", to be held at the Sheraton-Chicago Motor Hotel on April 29-30 and May 1.

Make a special effort to attend! Talk about the program to your associates. And above all, call attention to BRI and the Spring Conference among the young men in your organization so that they too may learn and profit from BRI associations as many of your top executives have in the past.

I look forward to seeing you at the Spring Conference in Chicago! ☐

Totally-Manufactured Building Modules:
THE CASE FOR INSTANT SPACE

The race to put more buildings in place in less time is pressing the construction industry to develop quicker and more industrialized building methods.

This race has been dramatized by former President Johnson's challenge to the industry, to produce 6 million housing units in the next decade, to meet the needs of the ghetto. Add to those 6 million units the schools, offices, clinics and other community facilities required by the families who will occupy them, and the seriousness of the need for faster construction techniques becomes painfully obvious.

Realizing the nature of the constraints on traditional building methods, the building industry has been turning more and more to the factory and production-line techniques used in other segments of the American economy, to produce building modules. Many such modular systems can be assembled or erected on the site in a matter of days; some in hours—providing, almost literally, "instant space."

A year ago, the Building Research Institute sponsored a Chicago conference under the chairmanship of Robert M. Engelbrecht, to explore the technology of totally-manufactured building modules.

In addition to the factory fabrication of modules, provision of instant or near-instant space involves skillful manipulation of other factors, such as transportation, siting, placement and connecting, environmental conditioning, even financing. Speakers at the two-day BRI conference explored aspects of each, and hazarded a few predictions concerning future technological potential.

The papers presented at the conference are published in the following pages, together with illustrative material. Regrettably, a few papers had to be omitted, either because they were not available or because of prior publication commitments. The papers presented here will provide the reader with an overview of present technology, even though not all existing building systems are represented.

Certainly, instant solutions for long-standing problems are not always possible. The problems of land cost, a major factor in providing housing for low-income families, social acceptability, long range planning—cannot be solved by devising more innovative alternatives to conventional stick-built housing. The effort must involve financial institutions, sponsor groups and representatives of government at every level as well as the design professionals, contractors, homebuilders and manufacturers.

But the technology of producing instant space is, at least, enabling the building industry to take first tentative steps on what a *Progressive Architecture* editorial recently called "the meandering path to 6 million homes." ☐

The Manufactured Module—Concept to Reality

Robert Martin Engelbrecht, AIA

"Century 21" house at Seattle World's Fair.

We are inclined to treat totally-manufactured transportable space as a contemporary building science, just being discovered. The fact is that the fundamental makings of the art (and its acceptability) have been around for a long time. And although we tend to think of all building construction as being in a fixed, established permanent location, we find that historically the nomad, the professional conqueror, the journeyman, the sailor, the riverman, the frontiersman, have all traveled, towing or riding their domestic shelter.

Fundamental human characteristics have brought us through history to this contemporary era of building technology concerning factory-manufactured, factory-assembled transportable modules of space. Some of these characteristics involve man's historic relationship to transportability—namely, his discontent, which motivated adventure; and his wanderlust, which motivated migration. Down through the ages, men so motivated have carried their domestic environment with them, variously in the form of tents, rafts, covered wagons, railroad cars, yachts, automobile trailers and trucks; thus fermenting the evolution of transmobility.

A second set of human characteristics have shaped man's historic relationship to industrialization—his laziness, which motivates his inventiveness; his materialistic greed, which motivates his accomplishment. Through the ages, men so motivated tended to evaluate accomplishment *numerically,* thus fermenting the evolution of industrialization.

As an industry, we of the building sciences are just now becoming fully aware of the processes which are constantly bringing *our growing needs for living spaces* and *our technological industrialized capabilities* on a collision course, which effectively allows us to hold BRI conferences on *totally-*

manufactured, factory-assembled modules of space. However, as individuals, many of us have been aware of these circumstances for a long time. When I agreed to chair such a conference and approached potential speakers, I was challenged with two questions:

How long have you been interested in transportable space? (This question asked by an architect in a hushed tone which suggested suspect conduct—perhaps of being a traitor to my profession, to architecture, to the creative aspect of being an architect. As it turned out, my questioner and I were both agreed on the obvious fact that a building module is a module of building technology, whether it be a brick, a block, or a total room.)

How long have I been interested in transportable spaces? For as long as I can remember!

Between 1928 and 1932 I had my first experiences with transportable dwelling units. These still live indelibly in my mind. The earliest memory was of a group of gypsies with their horse-drawn wagon homes. Annually, they camped on an uncle's farm along the creek (and reportedly ate snake meat). Their homes on wheels were ingenious and well-equipped. I helped the local blacksmith reset the iron tires of one of the brightly-painted gypsy wagons. (I remember my concern about damaging the intricate decoration, lest they hex us.)

The second experience was during the construction of US Route 54. The workers traveled with their families, living in tents, in wagons, trailers, and in homes mounted on trucks, all of their housing units were fascinating in their individuality. They parked *en masse* on our lands and I remember their children, travelers of the world (and no school!). I also recall their worldly, colorful and vulgar speech. Their homes on wheels also needed repairs, and I had first-hand opportunities to examine the fascination of their transportable housing units.

A third experience came when our family took an extensive trip along the then-new, now-famous Route 66. My impressions consisted of an endless chain of tourist cabins, ornamented tractor trailers and the unique experience of seeing manufactured house trailers. When we returned home, my brother and I built toy models of our versions of a trailer home from tubular Quaker oatmeal boxes.

Our toy version of a trailer home inspired our parents to think about building a full-scale version. Its design was executed mostly by my mother, who has always been a frustrated architect. It was obviously influenced by the historic covered wagon, the yachts of the rich, Buck Rogers' space ship, and Frank Buck's African safari caravan, then in the news. For all its ingenious use of space, with interior details as efficient as those in today's travel trailers, it also looked a lot like an oatmeal tube on wheels.

A fourth experience resulted from our getting out of bed at 2 a.m., and driving 15 miles to a railroad siding to watch the "Greatest Show on Earth" unload. Never has the concept of instant, transportable space been more dramatically presented and its purpose more emphatically validated for me, with 50 railroad cars, hundreds of people, scores of utilitarian spaces on wheels, all arriving, setting up business, and departing, all within 24 hours. I remember only a few of the acts, but the graphic demonstration of transportability and environmental creativity remains in my mind in infinite detail. The circus "modules" ranged from bunkhouses for the roughs, to the gilded, rubber-tired opulence of Mr. North's own quarters.

The second question put to me was "What do you know about manufactured buildings?" What do I know about factory-manufactured structures? For almost 20 years I have listened to the laments of people in the construction industry as they talked of our failure to emulate the leadership of other industries. We in the construction sciences tend to compare, describe our backwardness in terms of, and relate our lack of orderly industrial sophistication to one other large segment of our national economy; notably the automobile industry. Henry Ford's most important influence on the country was not his alleged invention of the automobile. His influence was in synthesizing the art of industrialization, the mass-producing of one product for everyone (as long as it was the same identical product) i.e., a repetitive package.

Applications in Housing

In the past, the construction industries have for the most part chosen to ignore that most fundamental principle of industrialization, a principle which can result in expediency of productivity; expanded and improved performance of product; lower costs for higher quality products. Instead, the construction industry has continued to promote *customizing.* The prefabricator will promote his flexibility, his diversity; the home manufacturer will brag about the breadth, the length, the number of house plans, and the styles available. The mobile home manufacturer will produce from one to five totally-different designs per day, on the same assembly line.

In 1952, when I was an associate in another architectural firm, and we started investigating professionally the possibility of having hotel rooms factory-manufactured for one of America's larger hotel chains, it became quite obvious that the hotel/motel room is an ideal architectural product for applying the principles of industrialization, since, with the exception of lefts and rights, the rooms can all be identical. Only the furnishings

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Robert Martin Engelbrecht has his own architectural firm in Princeton, New Jersey. He is a member of the BRI Operating Committee and of the American Institute of Architects. He has served on the AIA awards committee.

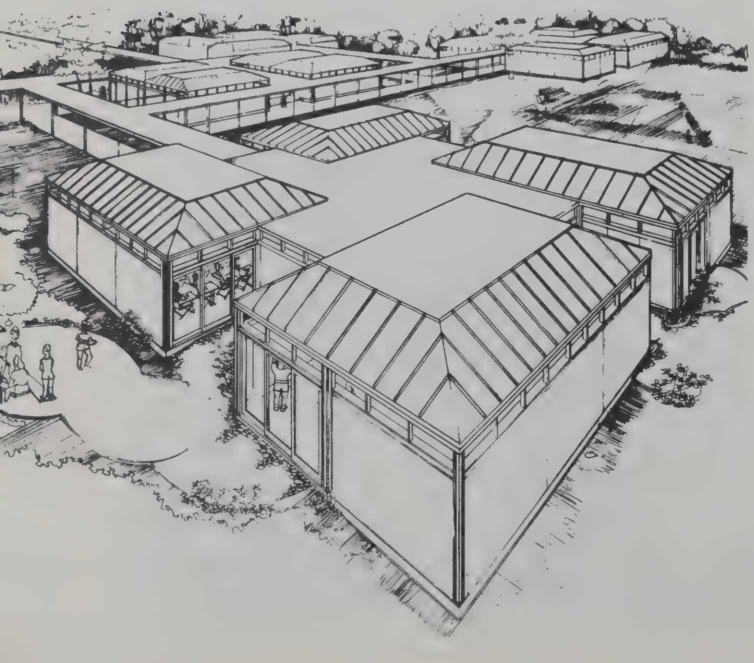
need be varied to create usage differentials. This 1952-54 design analysis for the hotel/motel room pointed up the fact that almost any design problem dealing with multiple, similar, pre-defined spaces, i.e., apartments, schools, clinics, dormitories, could be resolved with totally manufactured modular spaces.

In 1956, after I formed my own architectural consulting practice, I became Director of the Basic Materials Design and Research Program for Housing, which was sponsored by a shelter publication in concert with eight building material manufacturers and trade associations. Eight nationally-known architects were assigned to that program, each to represent a generic segment of the building materials industry. Between 1956 and 1958, I traveled with each of these architects to the research facilities, to the mills, and to the fabricating plants which best represented the manufacturing technology for the generic material classification assigned to that architect.

The Century 21 House

Carl Koch, one of the eight consulting architects, was assigned the aluminum classification. My travels with Carl included mobile home manufacturing facilities; as a result, my interest in the potential of the manufactured module was greatly intensified. In 1961 my firm was retained by the Seattle World's Fair Commission to develop a believable, predictive domestic shelter-oriented project for that fair. The Century 21 Living Space Modular Research House became our inevitable answer. The C-21 project was based on using four identical primary space modules. Each space module was identically equipped with a basic plumbing system, a basic heating/cooling system, and a basic primary electrical system. All these environmental control systems were integrally engineered into the floor plenum structure, leaving an unobstructed interior space, uncommitted to specific use. Functional spaces such as kitchen and baths were treated as secondary components, plugged into each completely-finished primary module of environmentally-controlled space. Each completely "functionalized" module was then hauled to the building site and hoisted onto the foundations with a construction crane.

Cluster of modular classroom units.



In concept, the design tools which we developed for assembling each uncommitted module of space were as follows: a structural floor plenum panel, fully equipped with the environment facilities; a structural wall frame system; a structural roof panel, and three types of wall filler panels, which could be used in any combination from all solid to all glass.

The fabrication concept was simply one of continuous sub-fabrication of components; inventory storage of components; primary assembly of basic modules from components; secondary installation of functionary components (i.e., kitchens or baths) on order; and shipping to destination.

The literature at the Fair heralded the house as "The American home of the immediate future—a house which takes one day to order; only one day to assemble; only one day to ship; only one day to install, and on the fifth day, the key is yours!"—or something like that. Thus, our first "case for instant space"—almost literally. We were not retained until late October 1961, the fabricator was not selected until February 1962, and the house opened ahead of schedule on April 9, 1962, complete with staff, special literature, and a taped narration.

Following the Seattle World's Fair project, we were awarded funds for the "Space Enclosure and Space Control Research Project." Several modular construction systems were developed during this period, including our patented, aluminum extrusion clamp beam which is used with stress skin panels, and with which we designed the US Trade Fair Pavilion in Sydney, Australia for the Department of Commerce. This pavilion opened in Sydney just four months from the day we were retained to do the project. The schedule went like this: one month to design and develop the pavilion (and sixty integrally-designed exhibits); one month to fabricate; one month to ship to Australia; two weeks for a pier strike, and two weeks to erect the pavilion and install the exhibits.

Our most extensive development work during this period following the Seattle World's Fair was for educational facilities at the elementary school level. These studies were all based upon a modular concept, using a modified steel space-frame technique for receiving panels fabricated of fire-resistive materials. Again, the development emphasis was on a minimum number of standard panelized components which, when assembled, resulted in identical modules of space. For classrooms, two identical halves were developed for tandem shipping. Side-by-side site installation completed the space. For activity spaces, two types of modules—an end-module and an inter-module—were developed. Variable room sizes were developed by adding or subtracting inter-modules.

For members of the Council for the Advancement of Small Colleges, we have been developing two other kinds of modular systems: one for married students' housing, which is composed of a living-space module, which contains all the functionary spaces, such as kitchen and bath; and a sleeping-space module which must be used with a living space module to function. Each two modules function autonomously. These modules can be stacked two stories high.

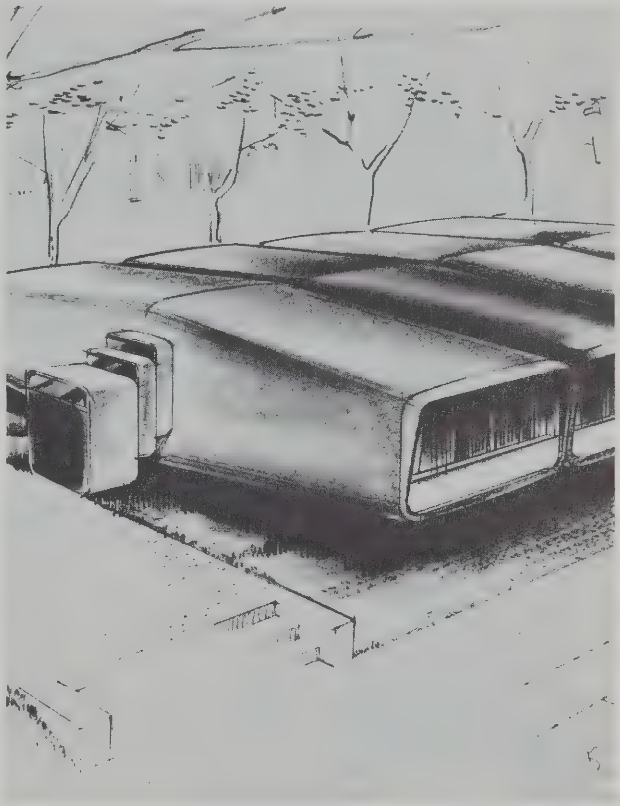
The second type is a dormitory module.

Filament-Wound Structures

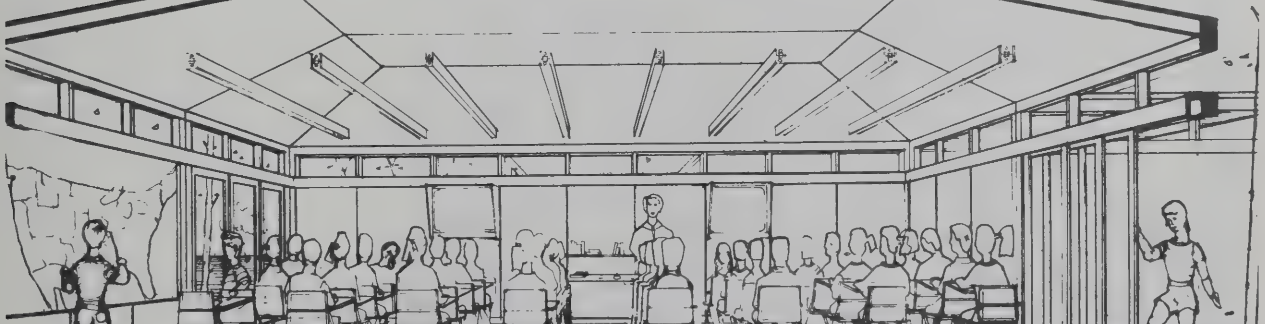
In 1956, I got to know Richard Young, who is one of the world's foremost authorities on filament winding of fiberglass components. Over the years we have discussed the potential of using filament-wound fiberglass for building components. The following design studies are for building components which could be built with the existing technology developed by the Young Development Laboratory for the aerospace industry. Another article will deal with this topic in greater depth; however the possibilities inherent in this technology are fascinating. Consider filament-wound vacation house modules; with two modules connected to give an expanded vacation house; modules used as dormitory, motel, or clinic rooms; or racked in a structural frame to form multifamily housing. The module in each of these examples is formed by winding an interior surface and reinforcing bands over a form (mandrel); overlaying this with insulation; integrating the environmental control systems within the insulation thickness, and overwinding an outer exterior surface finish. Its adaptability to automation and its weight/efficiency ratio will stimulate broad interest in the future of filament-wound packages of space.

The Second-Home Market

My last "case for instant space" is a modular system for vacation houses. For many years it has been my contention that secondary housing (such as vacation housing) offers the greatest opportunity for design innovation. Houses today are not what people really want, since the design is influenced and limited by numerous deterrent factors with the result that primary housing is burdened with com-



Above, filament-wound units; below, modular classroom.

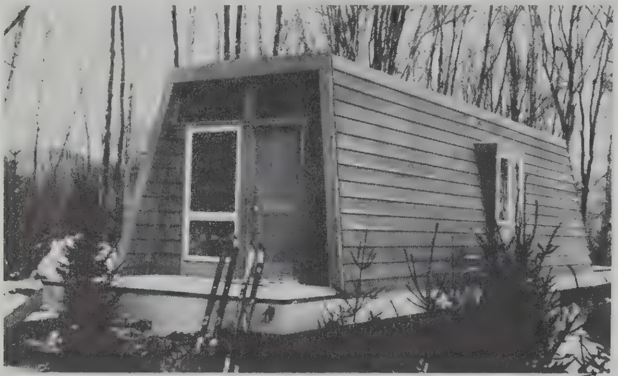


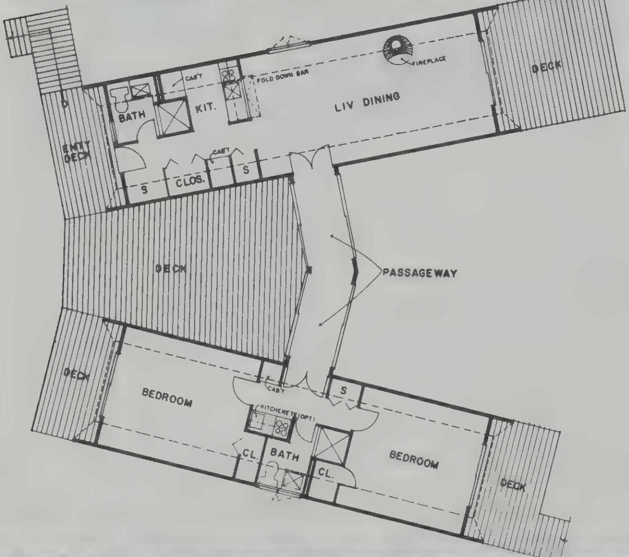
pounding status requirements and performance criteria. The vacation home is as much an escape from this as it is from a daily job or routine. I am convinced that the freedom allowed in the design of a vacation home will become the best educator in upgrading present public taste and judgment in housing. The simplicity of styling, compactness and efficiency of equipment, combined with permanence of finishes and low-maintenance building materials all contribute to relating contemporary living to contemporary design.

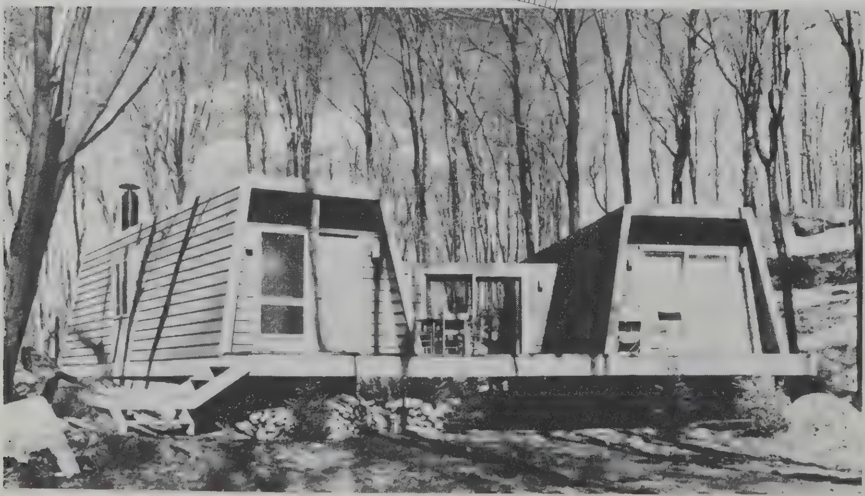
The manufactured modular concept of an instant ski lodge or an instant beach house is in keeping with the affluent society's remarkable appetite for instant luxury boats, instant motor homes, instant status, etc. This system consisted of an A-module, basically a glorified studio apartment with sleeping accommodations for two or four and with bath and kitchen areas; and a B-module, which contains two bedrooms, a bath and a pantry kitchen (or laundry), and sleeps two to six. Each module is totally self-contained and fully equipped, with the environmental systems which allow one module to operate independently of the other. As in the C-21 house, the structural frame acts as a construction collector into which are integrated the environmental control systems, which incidentally, are designed for temperatures as low as −20 F. with 50 mph winds. This frame is also especially engineered to allow each module to be hauled over the road, on detachable running gear; flown, supported by the two frame extensions; placed on a foundation or on four piers, and cantilevered 25% at either or both ends. It is becoming increasingly evident that the often predicted revolution in building technology, the factory-fabricated building, is no longer around the corner—it is here!

However, this revolutionary development doesn't always have the architect's stamp of approval from the standpoint of aesthetics; the engineer's contribution of ideally-controlled environmental function, or efficient structure; the general contractor's guarantee of endurance and performance, or the mortgage banker's enthusiasm as a sound investment. In fact, this revolution sometimes appears to have been motivated by promoters and entrepreneurs from businesses outside the typically-known building fields. These "opportunists" have been received with open arms by that important central character to any successful venture, the customer/client. As a result, there are a few new vibrations in the staid old halls of building technology.

Factory-fabricated and factory-assembled building modules represent a dramatic projection of existing building science technologies. All their attributes and all the limitations need to be scrutinized and BRI intends to accomplish this, and to assist in "polishing the art." ☐







Modular vacation house—top left, single-unit house; center and left, two units connected.

Component Design For the Urban Environment

Carl Koch, Jr., FAIA

It is a sorry commentary on our failure to meet the crying need for decent housing for all our citizens, that we are now suddenly turning to "instant" solutions to problems we should have faced in a more rational way years ago. However, I feel it may be useful to trace the history of instant space ideas in some of my firm's work to illustrate some of the pros and cons of "totally-manufactured modules."

In the 22 years since the Acorn House, I have spent much of my time falling into or pulling myself, I hope, out of an important pitfall. This is the over-emphasis of initial cost against long-term maintenance, enjoyment, satisfaction, and more and more important as it daily accelerates, cultural and social change. I don't mean to single myself out among architects for these flaws. They are, so to speak, occupational hazards. Please try to keep them in mind throughout this story.

When one looks through the large number of building components that fall into the classification of "core" or "heart" units—the crux, as it were, of instant space—it is difficult to make a distinction between the terms. For the purpose of this paper, let us say that a *core unit* is one which has structural capabilities beyond supporting itself, while a *heart unit* is a plug-in component, implying an entirely-separate structure for the remainder of the building.

The design for the Acorn House, which was engineered, de-bugged, and built by John Bemis over 20 years ago, was in effect, a trailer with extendable living space. The core contained kitchen, bathroom and heating unit, and was the structural basis of the house. The solid, non-collapsing core logically contained certain spaces—kitchen, bathroom and heating apparatus—because they were fixed, and could not easily be displaced for transport. This division of functions amounts to the basic principle underlying this approach to construction.

There are two sorts of space-usage in the living unit—the heart space, containing appliances and fixtures, and the remaining space, which is the domain of "furniture." The square-foot costs of the two kinds of space vary greatly; in fact they render the over-all square-foot cost figures usually given for dwelling units fairly useless for construction analysis. Differences between these spaces, in terms of both construction and use, probably form the basis of most systems thinking in building, and are, therefore, worth enumerating. These differences are:

- difference in square foot costs due to different furnishing requirements
- different trades employed in finishing
- different relationship to services
- different degree of flexibility required by the user

This last point refers largely to the variations in space—rooms, privacy requirements and arrangements, as distinct from fixtures, utilities and equipment, which vary considerably less from family to family. These considerations have led us over the years to conclude that the structure of the building costs roughly 30 percent of the total, but the client, in building, as in choosing, cares much less about the framework than the plan relationships, finishes, appliances, and façade. Therefore, structure is a

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Carl Koch, Jr., is president of Carl Koch & Associates, Inc., in Boston, Massachusetts. He received his M.Arch from Harvard and is now a Fellow of the American Institute of Arctitects.

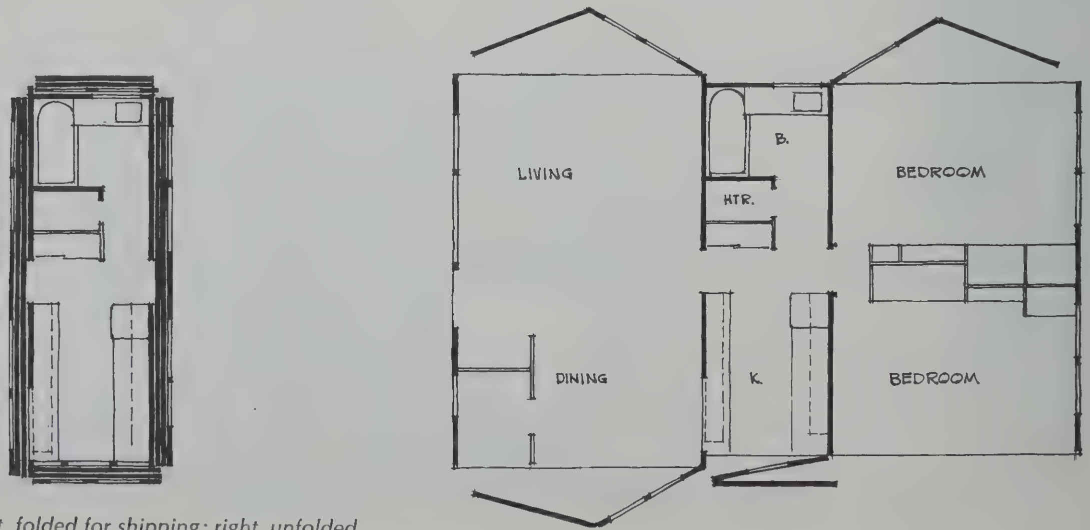
good place to standardize and offer economy if it is designed to be consistent with planning flexibility. At the time Acorn was being designed, we felt that the same criteria would apply to kitchen and bathrooms; that is, they could be standardized and produced in quantity at a saving without offending the client. At the time, this did not seem unreasonable. However, the Acorn House made not the slightest inroads on the market of its time. Only three were built, though 50 were ordered by the Department of Defense, and later cancelled. Consequently it came only slightly closer to realization of use than its illustrious predecessor, the Dymaxion House of Bucky Fuller. It seems that inertia displayed by industry when asked to design ahead of the market has some economic justification. I must also admit that it is probably a fact that when the market is ready for the Acorn House (or the Dymaxion House), *either* technological progress *or* social change will have rendered it obsolete. This is not to deny the value of such projects. They have, I think, a useful influence on housing and architectural thinking. It does mean that a line should perhaps be drawn between housing for the market and housing built for experimental purposes. Then no shabby compromises need be made in experimental work to make it sell. And conversely, probably no one should try to sell an experiment! But to expect this is wishful thinking. In our country, we tend to think any housing experiment must pay off the first time; hence our predicament.

Actual design of the core unit soon went beyond the attempt to pack standard fixtures into a box which could travel on the highway. The ideal core unit could be, at some future time, a single appliance performing a number of different functions, rather than a clumsy assembly of bulky single-purpose machines. This Bucky Fuller "black box" would be made possible by technological advance and factory methods. Among the concepts we arrived at along this road in the Acorn were the cooktop, the independent oven, and the drawer-type refrigerator. Though subsequent production and sales have justified most of these items, at the time they brought us little but headaches and the selfless pleasure of having done some free research for others. We began to see that the heart-machine concept could be a seductive siren, and perhaps in pursuing her we were by-passing the real pragmatic answer to this part of the housing problem. Technology or ideas which are unacceptable to the market have no more effect than the most esoteric theories.

Simplifying the Process

One plus-point of the Acorn House appears more vivid in retrospect. This is the success of the simple erection process. Until the box hotels recently completed in Texas, industrialized housing in America has presented a long slate of ambitious erection schedules, puzzled workmen and frustrated designers. Notable examples of this are the Lustron House, Bucky Fuller's traveling domes, and more recently the Alside House. In practically every case, the predicted installation and erection time is greatly exceeded in field conditions, when workmen try to cope with new ideas which look good on the drawing board but which are given up before a learning period can be completed. Acorn stands as a textbook-example of just how simple the process must be if the "tent is to be up before nightfall."

The simplicity of Acorn seems to be very desirable now in the perspective of 20 years of dealing with similar problems. An interesting step in the direction of standardizing more flexible components and changing our original concept of instant space occurred in the second version of the Acorn House. John Bemis persuaded me to give up the hinging idea in favor of bolting the panels together, since this permitted a great reduction in the number of sizes necessary, and simplified the hardware and connection details. Flexibility in



Acorn house—left, folded for shipping; right, unfolded.

thinking is perhaps an essential prerequisite of good flexibility in design.

The task given us by the USAF which gave rise to the Relocatable House was to provide housing which could be used for radar-station sites, which were placed at lonely, inaccessible spots and often moved. The USAF felt they would like to protect the investment put into housing by moving the buildings from base to base. They were also plagued by the difficulty of getting a very few units site-built in an inaccessible spot. This seemed a natural application of the Acorn House principle but we found no building material light and incombustible and cheap enough to meet the military requirements. Plywood stressed skin panels, which we had found completely successful in the Acorn House, were rejected as unacceptable. A successful aluminum sandwich which we had tried for in 1946 was still just around the corner. 2 x 3 panelized standard walls with plywood outside and sheetrock inside were finally used, and only a three-times-package-volume increase was achieved as compared to Acorn's five-times increase.

The walls and roof were attached, or rather hung, from the sides of the core for travel. This permitted a sufficient increase in size to fulfill the area requirements, but a number of different models were required to meet the military's original requirements. In fact, at this point, we began to realize that determining the size of the core-space by the requirements of the non-core space was a very limiting factor on design and had a very adverse effect on standardization. In addition, much of the so-called core space was only nominally that, and the core could permit much more collapsing.

Site Costs Prohibitive

The immediate lessons of such a project stem from the causes of its failure, or more strictly in this case, diminished success. As far as it went, the Relocatable House was a success. It worked. 1000 were built and lived in, and moved. In the process the Department of Defense decided that no distance was too far to move them and they were ultimately used for a far different program than that for which they were originally designed. But site development costs sopped up much of the savings gained by the ability to move. This was not a problem of foundation costs. The foundation used the same fast, cheap system used in the Acorn House. Admittedly, the sites for radar stations are an extreme case, but the site factor is always present. I feel, in fact, that pricing a house F.O.B. Detroit will be always unrealistic unless and until industrialization can deal with roads, utilities, perhaps even landscaping in a revolutionary manner. Economically, all industrial houses float slightly above the ground. Site costs usually bring them back to earth. For this reason the application of these concepts to multi-family multi-story housing, which minimizes site problems, promises much more at the present time.

One particularly revealing incident did occur in the USAF Relocatable House project. Though one is not taught to do one's own thing at Annapolis or West Point, the military in general do insist on houses being an extension of the uniform; that is, the higher the rank, the more closets you get, the larger your rooms, the more burners on your stove, etc. When the Relocatable House went out for bid, there were two alternative construction schemes, and four plans for each, a total of eight plans. Bids came in high. Cut it down to one plan, we said, and provide the extras, including space, as additives to be pinned on to the basic building. Then the bids came in within the budget. I mention this because we all have the feeling that this is the way things are, but so seldom do we see it demonstrated and proven as clearly as this shot was called.

The Lustron House, on which we were called in as consultants for the second model which never had a chance to appear, shows another possible pitfall of the core concept. Lustron had a marvelous stamping machine which turned a sheet of metal into a perfect Lustron bathtub in a couple of seconds. The problem here was that while Lustron envisioned a production of 40,000 houses per year, the gigantic machine had a cost break-even point of something like 120,000 bathtubs per year. When the attempt was made to market the oversupply, the slightly-different size of the Lustron tub (5 feet 1½″ as opposed to an even 5′) introduced a "special" for which there was no outside market—an object lesson in the strange niceties of building product standardization.

This example deserves serious consideration. One generally assumes that there are two great advantages to the heart concept: 1) well-controlled skilled labor indoors, and 2) production line quantity and quality. The years have somewhat disabused my faith in factory labor's ability to beat site labor decisively at the same work. There does not seem to be sufficient advantage gained by doing the job the same old way under cover, and they paying to have it transported. New designs and simplification are required to take proper advantage of the production line. The key to the situation is therefore an adaptation of the design of the core to industrial, rather than site-based techniques. The question then is just how to go about redesign, particularly in view of justified reservations about marketability of something out of the ordinary.

Lustron's bathtub is one classic example of how *not* to use manufacturing processes. It is quite likely in any case, that the economic break-even volumes of the separate core components will not coincide with one another and will be significantly larger than the initial market for cores. Therefore, if the operation is to be most effective, the components should be separately marketable. This argues against complete standardization of the whole set of fixtures at least in the case of most appliances. The experience of GE with their one-piece in-line kitchen is a good case in point. In what was in the kitchen appliances business a very small run—10,000 units—they had very poor marketing success and were forced to give up the project.

For a while, we gave up the notion of the single "machine-for-living" approach implied by Acorn and to a lesser extent Lustron. Indeed, in a research project for Lockheed, we designed a housing system composed of seven different component systems, each of which was adaptable to the present-day construction industry, and could, therefore, be produced in quantity at savings. I still believe very strongly that this sort of approach to housing problems is ideal—that is, introducing products which serve several methods of housing at once, so that each improvement is available to the entire industry. What is more important, the manufacturer is not required to rely upon the success of the new system alone for his return. Lockheed was not finally excited by the ideas as we were, or at least felt that they had all the problems they could handle in the air alone without tackling the earth's surface at that time. We had a heart unit in this system, too, but it was a real mass-production concept, usable as part of existing systems.

Moving on in time, Academy Homes II, our most successful urban low-cost project to date, relinquishes heart thinking as we have understood it to this point almost completely. Part of the reason for this was that practically everything else got left behind in an all-out attempt to prove the structural system. The "box" or "slot" which seems at first to be a good place for a core or heart unit is in fact completely filled by two separate stairs called for by Boston's fire code which answer for multiple access in multi-family housing. In this connection I was quite interested in comparing notes with Mr. Fowler at IIT to find that they had at the time I talked to them modified the pure concrete box concept on which they were working to a combination box and panel approach to get costs down. The optimist would say here that they were retaining the best out of each approach—the pessimist that they were accepting the problems provided by each. I am looking forward to hearing the answer provided by experience.

The existence of the box, the logical combination of bearing walls, shear walls and stairs, has led us to investigate a core that combines not only heart functions but structure and vertical circulation as well. The box and plank solution seems to be a natural simplification of the structural and circulation characteristics of the Techcrete system, but the relationship to services no longer seems so obviously to belong in a core, particularly in view of the solution to vertical services we finally arrived at. You will recognize Core 32, of course, as the multi-story counterpart of the thinking that went on in Acorn and the Relocatable House. The pros are obvious—they are the same as for the Acorn House. The cons of this type of all-purpose core solution have not had such wide currency, so I want to mention some of them at this point.

First is the space and weight appropriate to such a core commensurate with the functions which we try to pack into it? The limitations which we grappled with in 1946 are still there (road restrictions, etc.) though 10′-wide loads are now generally permitted and 12′-wide loads are much more frequent.

We have recently completed a new study for the Department of Defense, further developing our Techcrete approach. The plans show that the bath, kitchen and even vertical services can be handled away from the core. This approach was first developed in Academy Homes, with a narrower slot and conventional plumbing. Department of Defense plans proposed a central chase with four positions which can become bathroom, kitchen, lavoratory or laundry. Plumbing is Sovent—ventless plumbing achieved by means of a patented mixing fitting, and provides a very simple standardized tree. Fixtures were organized into flexible packages arrangeable in several ways. This makes them much easier to handle than full-sized heart units, makes for more combinations, and allows doors to be set up in the two open walls wherever they are desired. This yields a variety of solutions that no single heart unit could. Even when working with the elements of a bathroom, expensive as they are and comparatively restricted as is the space, the question as to whether it is efficient to ship the whole space as a unit is not easy to answer affirmatively. Not if you can build it in three or more pieces which nest, and can be carried through a 2′6″ door and be put together in a half-hour by two men with a wrench and a screw driver, and further if these three standard parts can be combined in 30 different ways—and in 100 different-size spaces with various standard or custom additives.

One begins to realize, while coping with two bathrooms, a powder room, a laundry and a kitchen for every apartment in this project, that the old core concept is already sub-standard for all but public housing. And yet to manufacture two, three or a dozen different heart units would possibly dilute the cost advantage of the idea beyond economic feasibility. Furthermore, the social importance of housing being abundantly clear, we should be wary of any device such as a stamped-out bathroom, which fixes standard of living, no matter how high it may seem today. A more adaptable solution seems to me desirable. With appliances, choice and change, not only functional but also in terms of color and finish, are important now and will become more important. The bathroom is no longer a standard item. Anything which completely restricts choice and change will soon be substandard. I am reminded of the woman I just read about who is divorcing her husband because he spends most of his time at home in the tub, working on a foolproof way to lick the numbers game. A flexible bath layout might have saved their marriage.

Stacking the Boxes

There is no question of the need for instant space or for totally-manufactured modules. Nor for a number of approaches. If we could but spend a part of the energy wasted in endless discussion of the box versus the panel, plastic versus aluminum, etc., undertaking more valid research and development work on the total product using the alternates proposed, we might begin to get some effective answers. The effectiveness of the trailer industry, in satisfying a tremendous market which the conventional building industry has so far failed to touch, is proof enough of the validity of the totally-manufactured module concept. I choose, however, to emphasize a point that I have had rammed into me over the years. *There is no such thing as a totally-manufactured living module.*

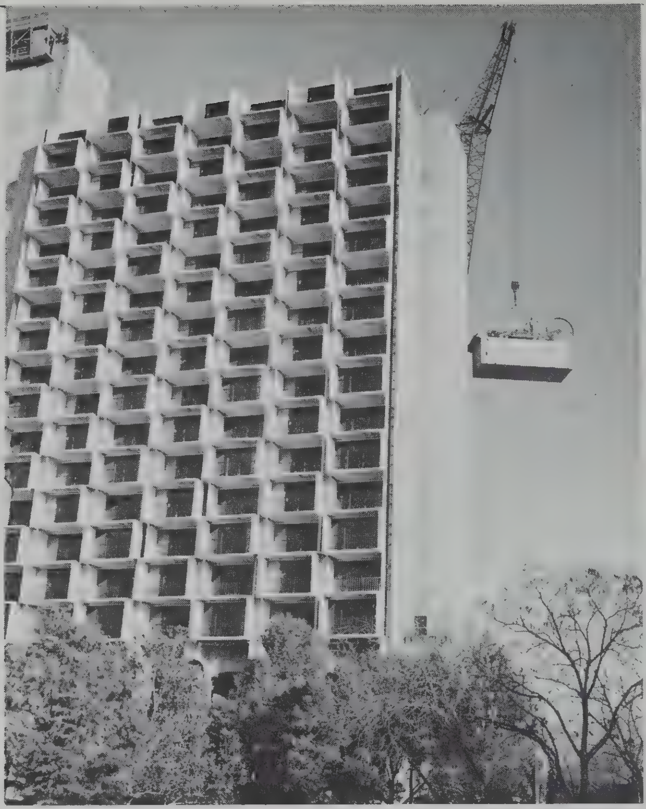
We have learned slowly and terribly painfully that even the automobile is not self-sufficient. Without adequate roads it cannot take us anywhere. And in the expensive process of enmeshing our cities and countryside with cement ribbons for our transport modules to run on, we are finding that we haven't gotten anywhere we want to be when we arrive. The same for housing. The best and most completely designed and manufactured box in the world is only a small component of a satisfactory living environment. It must be hooked up to all kinds of local facilities, both traditional and constantly-expanding new ones. And the same boxes can be put together either imaginatively, as in Habitat, or unimaginatively, as in other projects. When hard-headed successful characters tell you it costs $100,000 to do it the first way and $5,000 to do it the second, you can bet which kind is going to get built. It is quite possible that Bob Engelbrecht, Paul Rudolph and Moshe Safdie may rue the day they ever made the box acceptable. Because the totality is more than the sum of its parts. The totally-engineered component is, I am afraid, too easy an out for industry, and once they have found a market for them we will be in more, rather than less, trouble. There are very few trailer camps where I would be willing to live, though I could be quite happy in a number of trailers I have seen. Just because Rudolph, Engelbrecht and Safdie can make a heaven on earth out of a pile of boxes does not guarantee that their example will be followed. Smaller, less-complete components perhaps can be even more ruinously assembled, but the chances of success may be greater and the necessity for creative genius in doing it less. The necessary degree of flexibility is the critical concept here.

There is no question of the need for larger, more complete industrialized building components. There is something quite limiting, though, in the portable plant idea—at least for the present. A portable plant has all sorts of space, quality control, economic problems which can do a lot to offset the advantages they are set up to provide. And yet it is clear that transporting super boxes very far is not efficient. With Techcrete, our slab and panel approach (which is not really part of the topic of this paper), within a total construction experience of about 1000 units, we are already erecting four units a day and have estimated an equal completion rate with the latest finishing and equipment components we are proposing. It is nearly as fast as piling up completed boxes, and a great deal more flexible. And it has already shown very substantial cost reduction.

This also seems to be the most feasible approach for the manufacturer—components which are divisible into sub-components and are thus available for wider, more general distribution. They can fit into larger core packages, or be installed in existing housing, as well as fitting into the flexible new plans. Thus, at the moment, I remain convinced that the modified "instant" approach is the most fruitful one available, both to the architect and the manufacturer.

In summary, concerned with the two main criteria of cost and flexibility of plan as we are, and having some experience with the vagaries of the industrial process, we are pleased and excited (though a little worried) by the prospect at last after so many years presented for instant acceptance of the instant space concept.

Here it is hoped that the systems developed can be broken down into functional units, rather than built up into preconceived groupings. This will require an approach and a design discipline not taught at any architectural school. In doing this, we will have to deal with a degree of flexibility and change that was always a bit beyond the notice of architects, and increases today at a rapid rate. I submit that there are a number of ways in which the box concept of housing, using either core or heart units, can be used to meet head-on the housing problems which face us today. General solutions must be sought on a different level more compatible with the capabilities of our present manufacturing and marketing system, and with planning freedom and individual choice. The real challenge, and I think we can meet it, is to design for standardization and mass production in a way that will provide more choice, more beauty, more freedom, not less. ☐



Totally-Manufactured Hotels Through Concrete Technology

Roy W. Gillette

The use of totally manufactured building modules from concrete is in a way a rather new idea. By totally manufactured, I mean completely furnished and ready for placement as an integral portion of a larger structure.

Systems building is not new and it has gained much more momentum in Europe than in the United States. Because of the vast amount of destruction during World War II, housing became critical and European ingenuity developed various techniques of systems building.

The use of concrete in the various systems in Europe was tremendous. Steel was in short supply and concrete could be produced quite readily. Since concrete can be so easily molded into various shapes, textures, panels, blocks, etc., it has been utilized in many systems building techniques. The low maintenance aspects, use of the room unit as a structural component and its adaptability to production-line methods makes concrete an excellent material for totally manufactured building products.

As my experience has been with the technique of utilizing precast concrete in the Hilton Palacio Del Rio project, my discussion will be limited to the project and some observations which have grown out of it. To fully understand the reasons for the innovations involved in the project which I am to discuss, certain related factors must be presented.

The Decision to Build

Several years ago, a group of San Antonio business leaders made the decision to stage a small world's fair in that city. Mr. H. B. Zachry was one of these men. As part of the fair plan, another decision was made to construct a convention center adjacent to the fairgrounds, which would remain as an integral part of the complex after "HemisFair 68" was over. Urban renewal funds were approved to purchase approximately 93 acres of land adjacent to the downtown area. A convention center complex, consisting of a large exhibit hall and meeting rooms, a theatre and a large arena, was completed before HemisFair open on the 6th of April 1968. (The fair closed on October 6, 1968.)

To house visitors to HemisFair and the convention delegates, new hotel accommodations would be needed. Directly across the street from the convention center and along the San Antonio River, a small plot of land became available. This piece of land, the larger portion owned by Mr. Nic Catalani, was approximately 54 feet wide and 350 feet long. This land was acquired by Zachry and Catalani and the decision was made to construct the much-needed hotel. Since H. B. Zachry is the Chairman of the Board of the H. B. Zachry Company, the choice of contractors was obvious. The die was now set for the construction of the 500-room hotel.

The architectural firm of Cerna & Garza and the structural engineers, Feigenspan & Pinnell were chosen by the contractor to complete the design team, along with Schuchart & Associates for the mechanical and electrical systems.

Construction Techniques

A meeting was held and many construction methods were discussed, along with various design techniques. H. B. Zachry made the decision to construct the hotel of prefabricated concrete room modules. This decision was based on the following:

1. A motel was built near Corpus Christi, Texas in 1966 utilizing precast and prestressed room units, and knowledge was gained on this project.
2. Critical path scheduling indicated that the hotel could be completed by the opening of HemisFair on April 6th.
3. The hotel site was blocked for construction on three sides. The only free side of the plot was Alamo Street and all construction must be accomplished from that side.
4. Precasting and complete finishing of concrete rooms could be done at an off-site location while the first four floors of conventional cast-in-place reinforced concrete could progress at the construction site.
5. The nine-month period available to construct the hotel dictated simultaneous off-site and on-site work.
6. Preliminary investigations by the architects and engineers indicated that the precast room units could be utilized not only as the room, but as structural components to form the structure itself.

Site Construction

On July 3, 1967, ground was broken for the foundation. Due to swelling soils in the San Antonio area, drilled piers with bell footings were designed to support the entire structure. The bell footings are seated in a blue shale formation at the depth of 37′ to 40′ below the ground surface at river level. The piers are 36″ in diameter and the footings are 8′ in diameter. The piers are on 14′8″ centers.

The first four floors of conventional construction contain commercial space, lobby, dining rooms, offices and meeting rooms.

The utility core contains four passenger elevators, three freight elevators, stairs and utility rooms. Another fairly recent development in concrete technology, slipforming, was used in the construction of the utility core. This utility core, 73′4″ long and 22′6″ wide, was topped out at 242 feet in 28 working days. This included a week of torrential rains from Hurricane Beulah. Other phases of the first four floors of site construction went on without incident.

Casting Yard

The casting yard consisted of two areas. One area was utilized for the installation of the casting beds and forms; the other for storing the precast room units for finishing and awaiting transportation to the downtown construction site seven miles away. The entire casting and finishing yard (approximately 17 acres) consisted of a cement-treated granular base with an asphalt emulsion applied to the surface. This cement treatment of the base saved many hours of down-time because of the frequency of rains during the casting operation. Construction of the yard complex started July 10, 1967.

The casting yard consisted of 16 steel outer forms installed on concrete casting beds. Eight interior forms were mounted on turntables between two outer forms. The inner form was moved in and out of each outer form before and after the walls and roof were cast.

The precast room dimensions vary in length only. One room is three feet shorter than the other while width and height remains the same. These dimensions are as follows:

Length = 32′8″ OD and 32′3″ ID
Width = 13′0″ OD and 12′2″ ID
Height = 9′1⅝″ OD and 8′5⅜″ ID

A 4′6″ balcony is included in the above dimensions. The weight of the fully-equipped room was slightly in excess of 70,000 lbs.

Each row of eight forms had air, water, and steam piped to it for cleaning and curing. After all reinforcing steel was in place, lightweight concrete was placed, consolidated and steam-cured. A three-

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hour preset time was utilized, then steam was applied for nine hours. A 12-hour strength of 3000 psi was obtained to facilitate handling of the units. After curing, the precast units were removed from the forms by flanged wheel gantries which straddled each row of eight forms, placed on a trailer and moved to the finish yard.

Critical path scheduling indicated that all room units should be cast by December 15. The first room unit was cast on August 15, 1967, and the last on December 12, 1967, just five months and two days after ground was first broken for the casting yard. During the entire operation, a quality-control section was in control of all inspection to insure that all steel and concrete placement, sequence of casting, and placement of piping and electrical conduits were in accordance with plans and specifications.

In the finishing yard, the room units were completely furnished, decorated and equipped, including windows, carpets, furniture and bathroom fixtures, and were stored for transportation to the construction site.

Erection of Room Modules

Completed room units were moved by truck from the finishing yard to the downtown construction site.

Since only one side of the construction site could be utilized for equipment, all of the equipment on the project was grouped on this side which is Alamo Street. When construction started, we had preconceptions as to how we were to get these 35-ton room units in place. During the planning of the project, a country-wide search was initiated to locate equipment which could be erected in Alamo Street to place these 70,000-lb. rooms on the far side of the structure. This distance was approximately 97′ maximum radius. Numerous plans had been devised and rejected, when we learned of a new piece of equipment which would allow us to place all rooms from only four locations in the street. This equipment was a Manitowoc 4000 with the ringer attachment.

Another innovation which greatly facilitated erection was a lifting frame conceived, designed and built by company engineers. The frame consisted of a pipe lifting frame with four sheaves at the corners to attach to the four lifting cable pickup points on each room unit. On the front end of the frame, a small aircraft engine was mounted. On the rear, a tail rotor off a helicopter was mounted within a protective cage. A mechanical power takeoff connected the two. Two small wheels were mounted on a basket arrangement in the center of the frame. These wheels could change the pitch of the rotor blades. By adjusting the speed of the motor and pitch of the rotor blades, the operator riding inside the cage could control the orientation of the room unit on the hoisting line. The crane operator, in radio contact with a signalman on the hotel structure, would control the height and horizontal movement. The lifting frame operator would control the orientation of the unit and any swaying tendency. In a very short time, room placement reached as high as 25 rooms per day and on the next to the last day, 36 room units were placed. All rooms were in position in just 32 working days.

Each room rested on a polyester resin leveling pad and a portland cement/sand mortar bed. Connections were made by weldments both vertically and horizontally and by a poured-in-place corridor slab.

No problems of consequence were encountered during the entire erection sequence.

Conclusions

A complete evaluation of this project developed information which I feel is significant.

One area is the coordinated effort of the architects and engineers along with the contractor, all on an equal footing under a project manager. This led to quick decisions on utilization of materials, techniques of construction, changes in plans, all of which had a definite favorable influence on time and material costs. Change orders were quickly implemented reflecting favorably on costs. Results on this project have led us to believe that this concept of teamwork between the architects, engineers and contractors is an area which the construction industry might investigate as a potential cost reduction area.

Many people have asked the question, "What is the comparative cost of the precast module system and conventional system of construction?" There is no answer to this question as the project was designed for the precast system. However, I might point out a few items for consideration, with reference to this project *only:*

1. The structure could not have been completed in less than nine months conventionally.
2. The congested site dictated off-site precasting.
3. Job safety was improved by allowing room construction at ground level.
4. Completing the structure in one-half the normal construction time develops a cash flow revenue over a substantial length of time.
5. The reduction in construction time reduced interim financing costs.
6. Precast room units result in an excellent insurance rate.

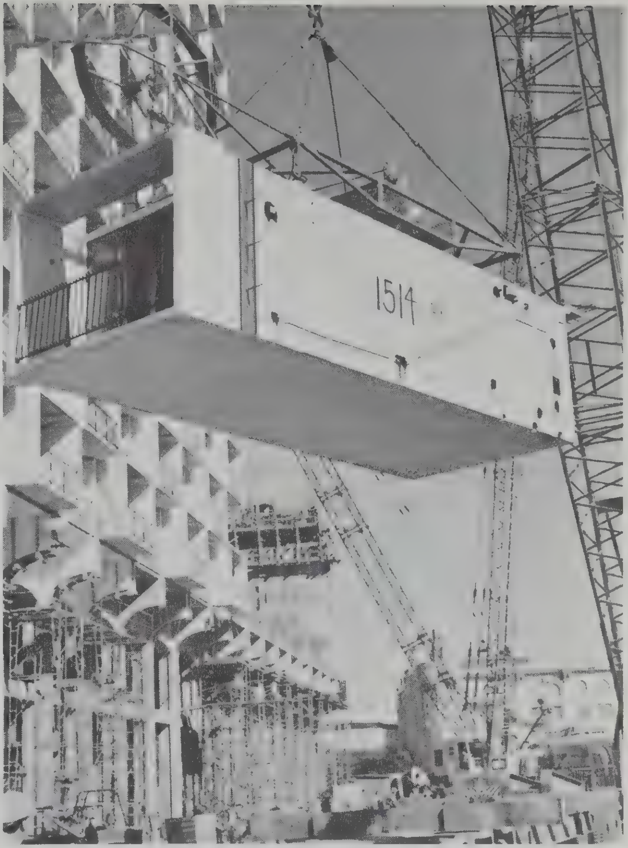
All items considered, for this project only, the precast module system was highly effective and allowed us to have a hotel where we could not have had one conventionally.

In my opinion, this project has developed criteria which definitely establishes a case for "instant space." I do not mean to imply that all problems confronting the construction industry can be solved by "instant space" but I do feel that for specific projects and areas of construction, "instant space" can produce economical and sound structures in a minimum of time.

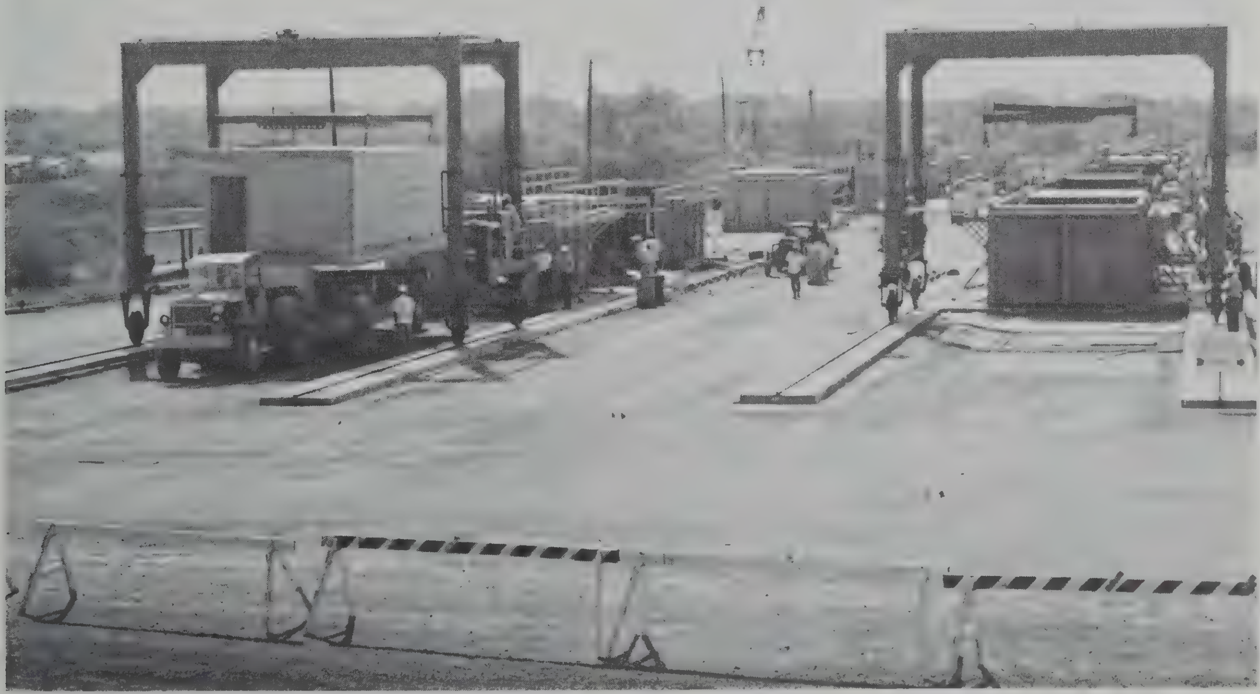
To obtain the ultimate in benefits, it is hoped that all facets of the construction industry will take new looks, not only at new materials, equipment and techniques, but also new concepts in management and organization no matter how they may differ from old and established means.

The use of manufacturing procedures to produce totally-manufactured building modules has many advantages. The same forms and equipment can be used over and over. Workmen become more skilled. Modules can be manufactured during the winter months and during inclement weather which saves on construction time. A work force can be maintained the year round and a reduction in on-site construction and equipment can be realized.

I hope we in the Zachry Company have stimulated everyone in the construction industry to look for changes in techniques, changes in materials, changes in management and above all changes in accepted ways and means of construction; however, changes just for the mere sake of change accomplishes little, but changes to accomplish a better and more economical end result are changes that are needed. ☐



Above, crane is placing a completely precast, finished and furnished hotel room. Note lifting frame with rotor control. Below, two rows of forms for casting the concrete room units. Photo shows the two gantries used for lifting units from forms. Gantry at left has lifted a unit from the form and is loading it on a trailer for trip to finishing-yard.



Habitat-Uniment System of Construction

Joseph Sherman

The present national policy, as set forth by former President Lyndon B. Johnson in his 1968 housing message, calls for a national goal of 26 million new housing units during the next 10 years. This rate is 10 times the housing replacement rate of the last 10 years. Added to this, there are over 30 million Americans presently living in some 10 million dwelling units which are rated as substandard by any of the numerous housing and/or building codes which exist in this country today.

When the number of housing units which will serve as replacement housing is added to the normal requirement for housing caused by population growth, the problem of meeting the Department of Housing and Urban Development's goal of a decent living unit for every family becomes an impossible task within the limits of our existing building technology.

It seems that most of the deteriorated existing dwelling units are located within our urban areas. In fact, I have seen figures which show that approximately 70 per cent of all deteriorated dwelling units are located in our cities and constitute a major slum problem. These units lack the minimum requirements for health and safety, and are characterized by old and non-functioning plumbing, inadequate and unsafe electrical systems, cracked plaster walls and ceilings, floors which are rough and unmaintainable, and doors and windows which no longer keep out the weather or intruders. This situation has become not only a national disgrace, but also a source of persistent community unrest, as evidenced by the report of the National Advisory Commission on Civil Disorders. This report places the housing situation high on the list of causes of unrest which led to the riots in our cities last summer.

I think we all agree that there is a tremendous need for housing today, and there will be an even greater need in years to come, as population increases and our present stock of marginal housing begins to deteriorate. With our present labor force, and only a 3 to 4 per cent unemployment rate, where are the men going to come from to rebuild our cities? With the present construction methods and existing labor forces, I dare say we not only will not meet the goal of 26 million units over the next ten years, but we might not even be able to replace units at the rate of existing deterioration.

The basic question which must now be asked is: How can we, the housing industry, meet the requirements set forth by President Johnson? But more important, how can we of the housing industry meet the needs of the people? How can we make the present slums a decent place to live; maybe even a desirable place to live? How can we eliminate the relocation problem usually associated with urban renewal? How can we build rapidly enough and on a large enough scale to make a significant inroad into the problem? How can we reduce costs?

The single answer to all these questions is to develop a building system designed with the intention of solving these problems.

System Criteria

In the development of technology, certain criteria which I feel are important must be met if we are to answer the needs of the housing industry. These criteria are:

- The units must be capable of being mass-produced under a controlled environment.
- The system must make a breakthrough in total housing costs.
- The system must be able to be constructed with the minimum relocation of existing residents through rapid "on-site" construction and extreme design flexibility.
- The system, if it is to be flexible enough, must be designed using fireproof construction, so

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that it can be applied to all types of density situations.

- The system must provide a livable residence.
- Units must be transportable.

Producing units in an enclosed factory under a controlled environment allows continued production seven days a week, 24 hours a day, rain or shine. The factory production also allows us to use either union labor or relatively unskilled labor, as the local situation allows. It also provides an ideal situation for the training of personnel in the construction industry with fewer problems than would be encountered in the field. Since mass production techniques are utilized, the required skills of the workmen are reduced to the extent that the hard-core unemployed can be utilized in the construction process.

The totally factory-produced system accomplishes the breakthrough in total housing costs because of the ability to improve the labor efficiency and reduce the materials content of each unit. This efficiency is accomplished by use of materials and cost controls applicable only to factory methods. No longer do we find material that is needed on the first floor located on the roof, or that all the doorknobs were stolen and must be reordered. In addition, construction-site time is reduced from months or years to just weeks, when a totally finished unit is developed in a factory. In most cases, this eliminates the need for interim financing. It also places the land back in the income-producing function much more rapidly.

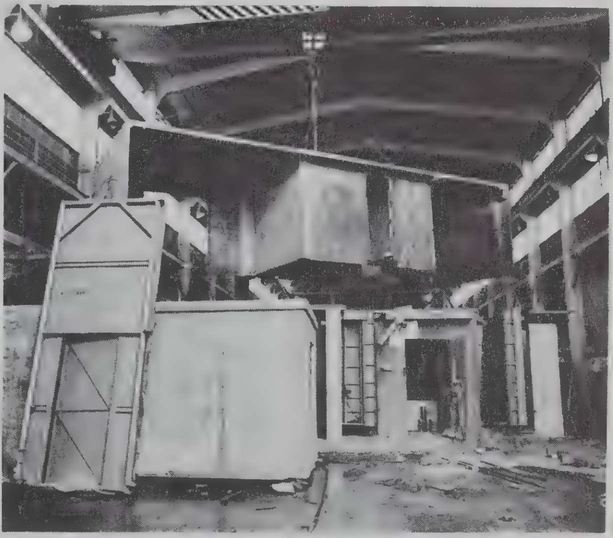
Minimizing Relocation

A volume module can be erected on-site with a limited amount of relocation of residents through both speed and design flexibility. The speed of site work allows us to do small parcels of land at a given time, thus allowing residents to remain in the surrounding area. Upon completion of the redeveloped area, a checkerboard pattern of development can be used to keep this relocation to a minimum. The design flexibility of the system allows the use of the modules in vacant lots between existing buildings. This vacant lot concept can develop into a complete neighborhood renewal as existing buildings deteriorate. The module system can be made flexible enough so that all architects can design individual buildings.

Flexibility in design to meet the urban situation requires that the system utilize fireproof construction. Concrete, being a plastic material, allows the architectural flexibility and meets the fire-code requirements of even the most dense urban areas.

The building system itself, unless it is very restrictive, need not govern the environment of a project or the livability of an individual dwelling unit. The individual architect designing with the system must have full control over the system, and not vice-versa. This allows the architect to create an environment after review of the local situation.

Transportation of the volume module from its point of manufacture to the construction site is most critical to the total concept. In fact, unless



Top right, Uniment module being removed from casting forms in factory. Left, stacking of module around precast stair-well and elevator sections. Right, finished Uniment building.

this problem is solved, concrete volume modules, although they meet all the other criteria, are not feasible for low-cost housing. For the purpose of continuing, allow me to set the transportation problem aside for a moment.

Now think for a moment about what a totally factory-produced concrete volume module can accomplish. It has taken the mobile home industry's ability to turn out a completely finished, low-cost product and combined it with the concrete industry's ability to produce a durable, relatively maintenance-free and fire-protected building.

Now that I have mentioned the basic concepts behind the concrete volume module, let us see how it works.

Habitat '67

The first application of a concrete volume module system that I know of in the western hemisphere was in Montreal, Canada and was designed by Moshe Safdie. The project was called Habitat '67.

Moshe Safdie used the concrete volume module as a means to produce what he likes to call the Habitat System. Habitat is considered an environmental, or living system, as opposed to a building or structural system such as I explained previously. The Habitat System offers the amenities of a single family residence and the density of a medium-size structure. It cannot really be classified as an apartment house, nor as a town house, but rather as a single-family house above the ground. Habitat, as in other attempts with concrete volume modules, experienced weights so high that transportation and erection were prohibitive from a cost standpoint. On-site factories were used in Habitat to eliminate the transportation problem. An on-site factory must be amortized completely over the number of dwelling units for a given project. When off-site factories are employed, units can be shipped to various projects within an economic radius and the highest amount that must be amortized on a given project is the cost of the individual form work. In most cases the forms can be used on a multitude of projects with only slight modification. Thus a much lower overhead cost will be reflected in the end mortgage.

The first concrete volume system utilizing advanced technology (to the end of lowering costs through significantly lowering the weights of the modules) has been developed and is now being used to construct a building in Richmond, California. The system is called the "Uniment System" and centers around a new and unique type of cement called ChemStress. ChemStress concrete was discovered in the United States by A. Klein and developed by CONRAD. This concrete actually expands, or "grows," as it sets. The expansion is resisted internally by placing high strength reinforcing bars within the molds. The tensile stress within the steel, as a result of this expansion, is subsequently transmitted to the concrete in the form of a compressive force; thus prestressing is accomplished. This prestressing is accomplished by chemical means and no mechanical apparatus is needed. Since the concrete expands in all directions, there is no limit to the shape of the prestressed member.

The Uniment Module

The Richmond Project consists of a monolithically-poured volume module, 11′ wide by 36′ long, which includes all interior partitions. The prestressing allows us to reduce the wall thickness from 4-6″ down to only 2″ which, as a result, significantly reduces the weight and materials content of each unit. The walls and ceilings of each module are poured monolithically and the floor is omitted. When the modules are stacked at the site, the ceiling of the lower unit forms the floor of the upper module. Two modules are joined together structurally in the field to produce a 3-bedroom living unit. Prior to leaving the factory, each unit is completely finished with the exception of the floor covering.

The site work consists of pouring the footings, erecting the precast concrete elevator and stair cores, and the joining of the modules to form a 24-unit, six-story elevator building. The total site time can be reduced, after the initial research project is completed, to three weeks—including the 24 to 36 hours required to erect the living units.

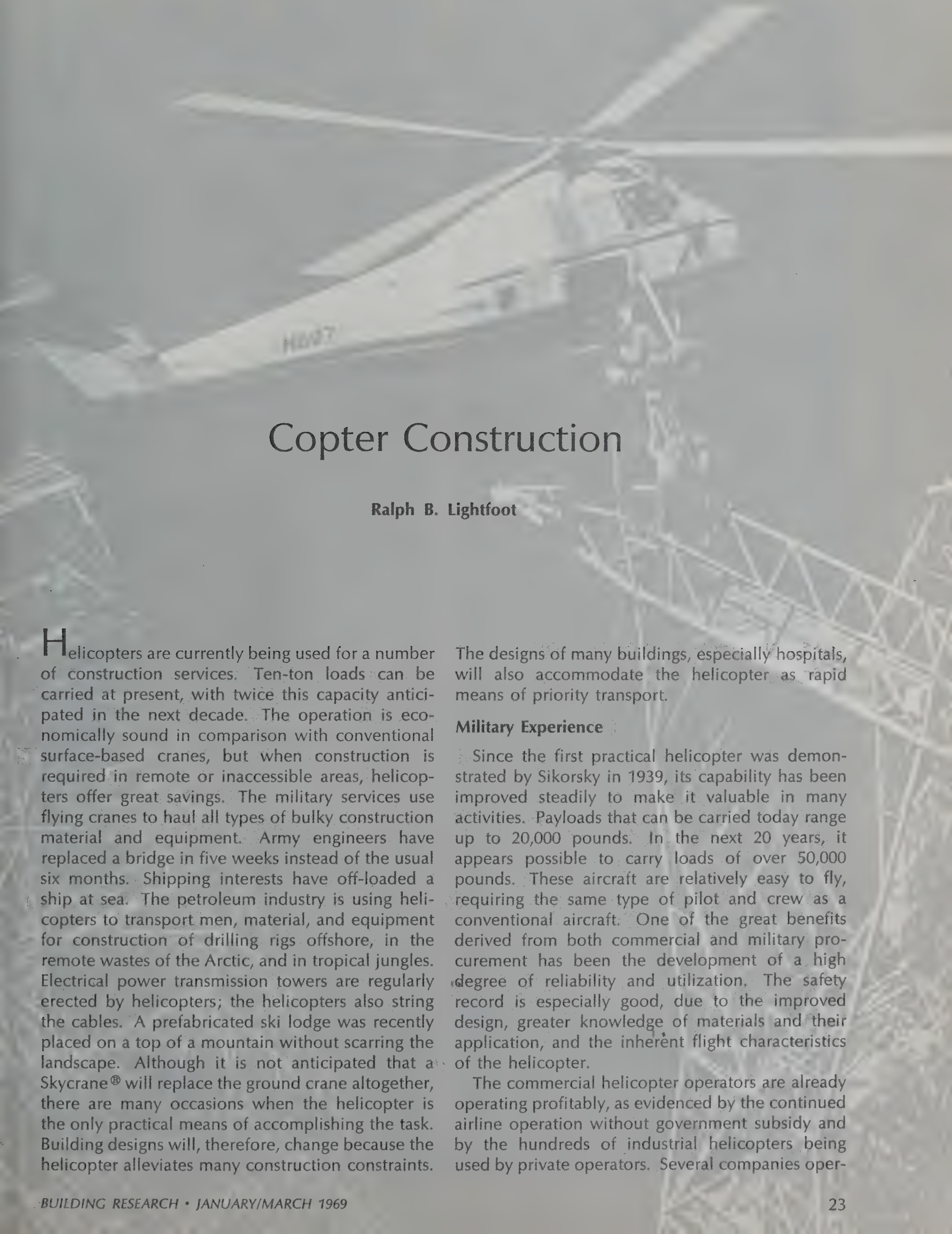
With this significant reduction in weight of the concrete volume module, (Habitat—17½′ x 38½′—90 tons; Uniment 11′ x 36′—11½ tons), the shipping of dwelling units becomes economically feasible. Although the width of a module is limited for transportation, a combination of modules and the elimination of certain partitions allows the architect to achieve almost any desired room size.

Since Habitat is an architectural concept relying on volume modules, and Uniment is an engineering system which as an end result produces these modules, the marriage of the two ideas was inevitable.

Other architects are using the concrete volume system and are producing buildings which are as different and individual as can be produced with conventional construction.

With the cost and time advantages of the volume module system, we may yet meet the demands for the quantity and quality of low-cost housing needed.

Henry Ford, a long time ago, showed us all that in order to meet the demands of volume and cost you must mass produce in a factory. Others since have shown us that this mass production does not eliminate individuality in design, as evidenced by the difference between the Corvette Stingray and the Model-A Ford. ☐



Copter Construction

Ralph B. Lightfoot

Helicopters are currently being used for a number of construction services. Ten-ton loads can be carried at present, with twice this capacity anticipated in the next decade. The operation is economically sound in comparison with conventional surface-based cranes, but when construction is required in remote or inaccessible areas, helicopters offer great savings. The military services use flying cranes to haul all types of bulky construction material and equipment. Army engineers have replaced a bridge in five weeks instead of the usual six months. Shipping interests have off-loaded a ship at sea. The petroleum industry is using helicopters to transport men, material, and equipment for construction of drilling rigs offshore, in the remote wastes of the Arctic, and in tropical jungles. Electrical power transmission towers are regularly erected by helicopters; the helicopters also string the cables. A prefabricated ski lodge was recently placed on a top of a mountain without scarring the landscape. Although it is not anticipated that a Skycrane® will replace the ground crane altogether, there are many occasions when the helicopter is the only practical means of accomplishing the task. Building designs will, therefore, change because the helicopter alleviates many construction constraints. The designs of many buildings, especially hospitals, will also accommodate the helicopter as rapid means of priority transport.

Military Experience

Since the first practical helicopter was demonstrated by Sikorsky in 1939, its capability has been improved steadily to make it valuable in many activities. Payloads that can be carried today range up to 20,000 pounds. In the next 20 years, it appears possible to carry loads of over 50,000 pounds. These aircraft are relatively easy to fly, requiring the same type of pilot and crew as a conventional aircraft. One of the great benefits derived from both commercial and military procurement has been the development of a high degree of reliability and utilization. The safety record is especially good, due to the improved design, greater knowledge of materials and their application, and the inherent flight characteristics of the helicopter.

The commercial helicopter operators are already operating profitably, as evidenced by the continued airline operation without government subsidy and by the hundreds of industrial helicopters being used by private operators. Several companies operate dozens of helicopters to perform all kinds of services, from special courier missions and the transport of men and material of construction, to actual construction work in remote areas.

To be sure, military procurement has spurred the development of these helicopters. The military services around the world have put these aircraft to use in many roles replacing both ground and aerial vehicles. In fact, the lifting and emplacing ability has prompted the US Army to establish a flying crane office for the operation of the larger helicopters. In South Viet Nam the Army has used these flying cranes to carry weapons and ammunition to remote outposts. These same vehicles have carried the construction equipment which built the outposts. Bulldozers, graders, trucks, sand, cement, steel and other construction equipment is being carried regularly. On several occasions the construction was virtually accomplished from start to finish by the flying crane. A 1000-ft. steel and cement bridge over the Song Cai River had been destroyed. Normal reconstruction would have required six months. The flying crane replaced each 59-ft. bridge section, weighing 15,000 pounds, in less than 30 minutes. The total repair consumed only five weeks, with the extra time being required to reconstruct the cement piers.

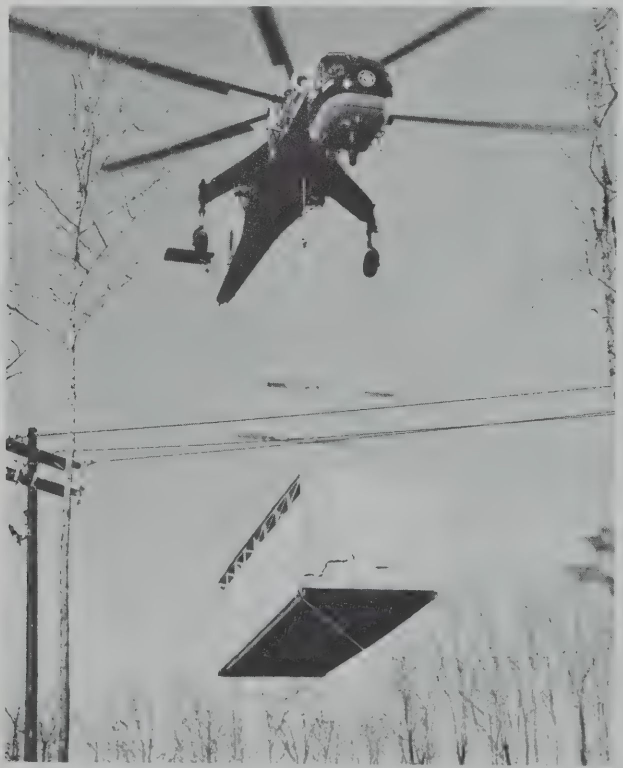
Shipping Interests

In many areas of the world, it is difficult and time-consuming to transport bulky equipment. Of current interest, for example, is the need to transfer huge cargo containers from a ship lying offshore to an inland destination. In January 1967, under very poor weather conditions, a Sikorsky S-64 Skycrane brought 31 containers ashore in five and one-half hours. The total weight transferred was 454,260 pounds. The containers measured 8′ x 8′ x 20′ and weighed up to twenty thousand pounds. No difficulty was encountered during the unloading or the loading of the container-ship, even though the seas were rough and the winds were gusting over 50 knots.

Petroleum Industry

Throughout the world, helicopters are being used by the petroleum industry. In the transport role, men are being carried on a regular basis to remote sites and particularly to offshore drilling rigs. Of special interest is cargo transportation involving bulky and heavy well-drilling equipment. Much of this equipment, such as pipe, beams, pumps, and machinery, is carried outside the aircraft in a sling. The rapid transit and speed of loading and unloading are very much appreciated, but the accuracy with which these loads can be placed in confined areas under adverse weather conditions is especially noteworthy. Quite recently the Skycrane has been used to evaluate the feasibility of transporting and emplacing very heavy and bulky loads of a critical nature.

It is one thing to build an oil-drilling rig, and the helicopter has been very helpful in the construction; however, once an oil well is producing, it is an economic necessity to sustain its operation. Various malfunctions can occur which require that the pumping be stopped. On many rigs there may be a number of well heads, yielding incomes of many thousands of dollars a day. Maintenance and repair procedures entail removal and replacement of heavy machinery normally employing a barge. At sea this can be done only in calm weather, and may require considerable delay. The expense of the barge and equipment is so high as to warrant its use only when several rigs nearby are in trouble. Weeks may go by without producing valuable oil.



Left, ski-lodge module being airlifted and emplaced on mountain-top. Right, helicopter replacing section of damaged bridge. Each 15,000-lb. section was emplaced in less than a half-hour; total repair time was five weeks.

In December 1967, the Skycrane clearly demonstrated its ability to remove and replace all the equipment needed to restore a well to production. Transfer of this equipment was accomplished in a matter of a few hours, rather than the several days normally required by barge transport.

Power Lines

As business, industry, and housing have moved away from the transportation and power-generating centers, it has been necessary to provide electrical power to remote areas. As Puerto Rico, for example, became industrialized, power could not be supplied to various sections of the island quickly enough by normal power-line construction procedures, due to mountainous terrain. The helicopter carried the crews to dig the holes, carried the poles and set them in the holes, poured the concrete footings, and strung the wires. All this was accomplished at low cost and in one-tenth the time normally required.

A spectacular job was done in 1962 when 300-ft. transmission towers were erected on the banks of the Hudson River. At the higher elevations the crews were carried to the top of the tower, and the next section was flown up to them by helicopter. At these lofty heights the bulky sections were placed so accurately that the men simply fitted in the attachment bolts. On a number of other occasions, the towers to support ski lifts were installed by helicopter.

Building Construction

In December 1967, the Great Gorge ski area in New Jersey desired a 300-seat lodge at the top of Mt. Hamburg, but did not wish to scar the face of the mountain by a road or the ruts of the construction equipment. The ski lodge was prefabricated by Continental Units, Inc. and trucked to the parking area at the base of the mountain. The Skycrane airlifted each section into its precise location on the footings at the top of the mountain. Each of the four sections measured 12′ x 48′ x 10′ and weighed 12,000 pounds, and the complete toilet facility measured 10′ x 30′ x 8′ and weighed 10,000 pounds. The total flying time involved was one hour and 20 minutes over a two-day period.

In December 1967, a modular construction hotel was assembled in San Antonio, Texas. Although ground-based cranes were used, each room was accurately emplaced up to the full 29 stories, utilizing a helicopter type rotor to control the position of the module.

It is readily apparent from these examples that the helicopter serving as a flying crane is a valuable, useful, and economical piece of construction equipment. In many applications, the helicopter is virtually the only apparatus which can do the job. It is not expected that a flying crane will replace a ground crane, but in many cases it might be considered. During some city construction work, ground cranes have not only caused traffic problems, but in some cases serious accidents. It is now probable that the Skycrane will permit construction techniques, architectural designs, or utilization of remote sites not feasible under current practices.

Quite apart from consideration of a helicopter as a piece of construction equipment, is the impact on building design simply because helicopters are here. Many cities now have helicopter passenger service, and more cities will have this service in the future. While the relatively free airspace prompts a preference for riparian heliports, the rooftop heliport offers numerous advantages. Many buildings, New York's Pan Am Building for example, make effective use of the roof as a heliport.

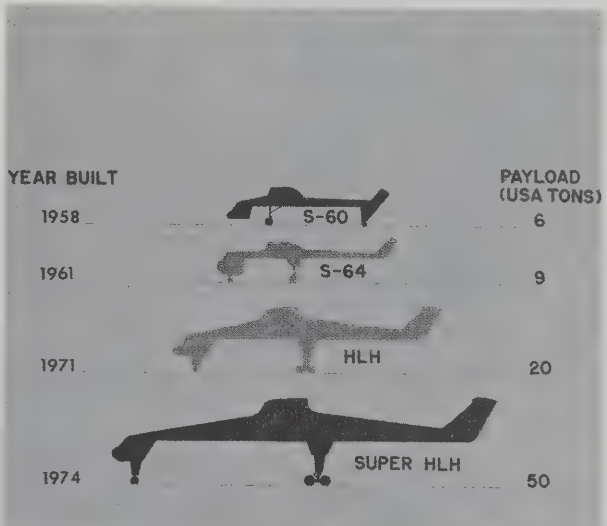


FIG. 1 POTENTIAL HELICOPTER LIFT

Hospital designs must accommodate helicopters for emergency service. Although the roof might be considered, most emergency facilities are located at grade level. With the trend toward open areas around hospitals, it is wise to consider carefully the hospital heliport when the site is being planned.

Conclusion

Although the foregoing examples are not all in the field of building construction, the types of work being done by helicopters are quite similar to the tasks required. Not only is there a wide range of lift capacity available, but the emplacement of material and equipment can be accomplished in a precise manner. With such ancillary equipment as a flying crane available, the designer should feel free to utilize new techniques and configurations to achieve more functional and desirable buildings economically. □

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Filament Winding As a Potential Building Process

J. Lowrie McLarty

The current technological capability of the filament winding industry toward a building module could be considered advanced—if the user would be satisfied with a large box of cylindrical structure having bare walls. The details of openings, attachments, services, floors and dividers would, however, require some attention. At present there are filament-wound tanks, being fabricated both in plant and on site, which are as large as private homes and offices. At least one group has wound one-room homes that are satisfactory from an economic standpoint. The purpose of this presentation is to describe the current capabilities and to assess the potential adaptability of filament winding to the totally-manufactured module.

The aerospace industry now uses filament-wound structures in place of steel, beryllium or aluminum, not only for reasons of minimum weight, but also for economy in tooling costs, shorter calendar-time from concept to use, and lowest manufacturing cost for each item.

One concept, although applied to a rocket motor of perhaps 50 ft. in diameter and several hundred feet in height, could be used to fabricate a shell of rectangular cross-section in the same manner. The method employs fibers of glass placed side by side. The fibers are then coated with resin and require time or slight heating to become rigid.

It has been reported that another filament-wound structure, 13 ft. in diameter and 24 ft. in length, is being used as a hyperbaric surgical chamber at Johns Hopkins Medical School.

Current Techniques

- A one-room home has been filament-wound by the University of Michigan School of Architecture. The structure, 16 x 12 x 8 ft. high assembled, was wound in 24 manhours at a cost of $570.00 for materials. Conventional wood structure would be $600 in materials and 80 manhours.
- In England, sections of in-plant filament-wound overwrapped foam and wood have been transported, assembled on site like staves in a barrel, then filament-overwound to make large tanks.
- United Technology has devised a system of making rocket motors, which has been adapted to make tubular structures. A mandrel of the required diameter or cross-section but of limited height, one story for example, is filament-wound. The mandrel is then reduced in diameter, the wound and cured section is raised and the mandrel is again expanded and overwrapped. A slight overlapping of the winding forms the joint. Again the wound section is raised and overwrapped. This process is repeated until the required height is obtained.
- Rohr Aircraft fabricates tanks (which could serve as bare-wall building modules) greater than 50 ft. in diameter and 40 ft. in height, on site. First, a base of concrete is cast as a foundation. A fiberglass-resin bottom, with a gear tooth pattern cast around its edge, is laid in place on the foundation. Wood forms are used to form the walls. A release film such as Mylar is used over the entire outer surface. Air-pressure openings in the foundation are used with a central air bearing to raise the fiberglass base. When the cast gear teeth are engaged, the entire form rotates past a fila-

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ment-winding station. After cure, the forms and film are removed for re-use. A roof is fabricated by hand lay-up methods over an inflated membrane.

- Goodyear has used inflated, nylon cord-reinforced polyurethane structures as a form for filament winding large containers with small end openings. After cure, the mandrel is deflated and removed through one of the end openings.
- Raven Industries of South Dakota, fabricators of immense high-altitude weather balloons, uses inflated Mylar forms for filament-winding large tanks. The forms are made using gores with taped joints. Very large structures could be made at low form-cost, using this system. After one layer is completed, the initial low air pressure can be increased to allow material to be deposited at a greater rate.
- Tufplas, an English company, makes structures over 70 ft. in diameter and 50 ft. in height by cementing or welding sheets of thermoplastic such as PVC, on site, to form the desired shape. The winding machine then travels around the circumference and also vertically, to filament-wind the complete structure.
- One of Justin Enterprise's tank fabrication methods which might be applied to a module is as follows: A thin shell is fabricated in plant to the required diameter and height. It is then collapsed by folding and shipped to the site, where it is allowed to return to its original shape; then overwound to the total thickness required.

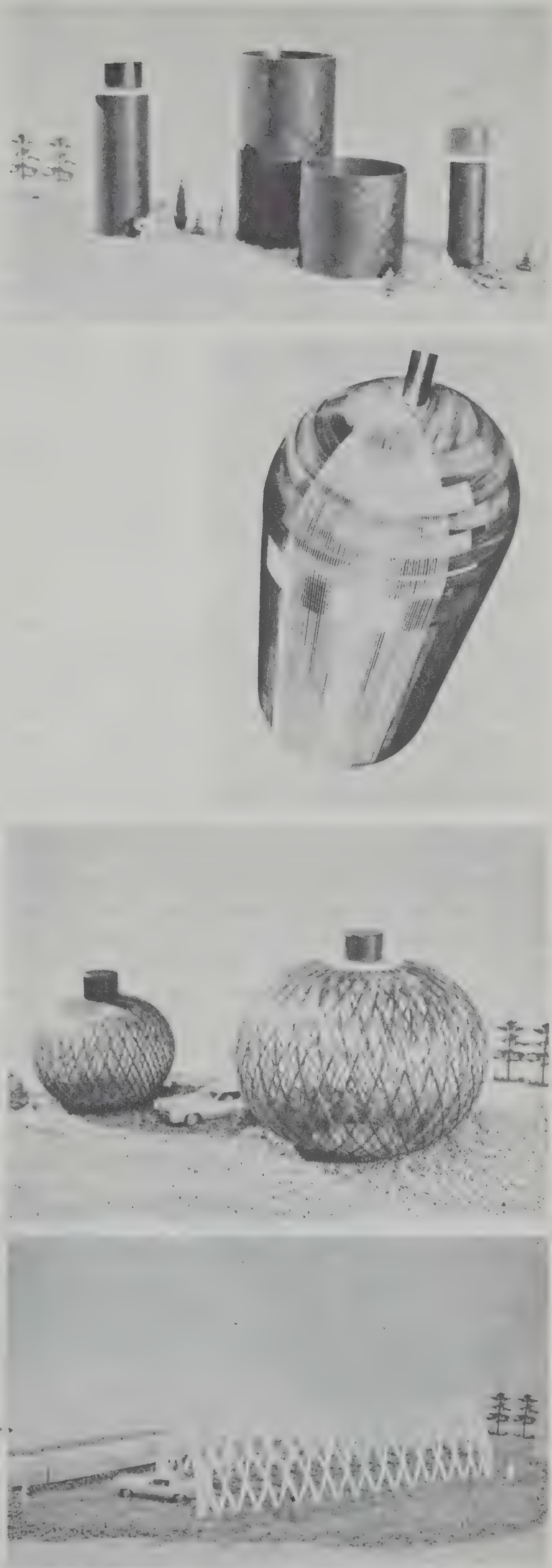
Unit Costs

At this time, raw material costs are $.31 per pound for glass roving and $.25 for polyester resin, resulting in a per-pound price of $.29 for the composite. Lowest selling-price for small filament-wound commercial products at present is approximately $.90 per pound.

The actual selling price of in-plant fabricated tanks, with some attachments, openings and fittings, (8 ft. diameter x 20 ft. long) is approx. $.60 per cu. ft. With the reduction in manpower envisioned within several years, this could then be $.35/cu. ft., or approximately $.60 per pound.

The University of Michigan one-room selling price, at their reported material and labor costs, would be $.50/cu. ft. using representative overhead and profit.

Machine deposit of glass and resin at present is as great as 3,000 pounds per hour. This is one-station delivery, and not the limit of glass deposit possible. Many stations could be used. At a rate of 3,000 pounds per hour, however, a 50 ft. diameter x 50 ft. high shell structure using 50,000 pounds of fiber glass resin (average inner and outer shells each ¼-in. thick), with roof, would require 17



Top to bottom; vertical structures formed by filament-winding process; section of wound cylinder, showing circumferential and vertical windings; spherical structures constructed of wound fibers; model of collapsible, foldable filament-wound structure.

hours of machine-time. Although other considerations have to be satisfied beyond machining a shell, the "case for instant space" does appear promising with filament winding performing in this manner.

Present large-tank costs are very dependent upon the liquid pressure loads, the quantity of tanks, the need for expensive resins to resist corrosion and other requirements not necessarily applicable to buildings. To achieve meaningful data, it would appear that cost-estimates should be based upon specific requirements, such as quantity, size and shape of the building modules, rather than present tank costs and requirements. Studies have shown that the fiberglass filament-resin combination compares with steel and wood in raw-material cost. The use of machine for fabrication of modules or complete buildings should further reduce the cost, compared to presently-used materials. The programs and calendar-time needed to satisfy building codes have not been estimated.

Providing Utilities

During the winding process, items such as electrical cable, plumbing and heating ducts can be put in place along the path of the fibers or along a separate path, and on the inner or outer surface of the structure or buried between windings. Thermal insulation can be also placed by machine in strips or bulk. Items such as attachment fittings can be wound in, with portions extending if desired. In addition, before cure or hardening of the resin, extreme deformation of the fibers can be made. Window-frames, door openings, ledges can be inset or molded to desired shape, using a separate tool to form the filament windings directly. Complete units such as the molded plastic bathroom could be placed on site in the correct position; other modules wound in-plant, forming other rooms, could also be assembled in the manner of building blocks on site. The entire assembly could then be overwound to form a complete dwelling. Sand can be sprinkled on the roof section before resin hardening.

Forming openings in structure after winding. Opening can also be formed during winding process, if desired.

Shells filament-wound on site to make homes and larger buildings could have conventional floors and rooms, using the shell for partial support. This shell might be rectangular, circular or any other shape having generally constant cross sections. The required openings could be wound in or cut after hardening. The form could be short, with each wound section raised in turn to form a vertical joined series, or of film-covered sections removed after hardening.

Using inflatable structures, various combinations of ovaloids, spheres and cylinders appear possible. Using collapsible forms increases the variety of shapes to include conical, rectangular and various combinations able to be overwound with continuous filaments.

The machinery required for first modules appears to be on hand in prototype form for in-plant and on-site winding. The investment appears low for larger units and may be available very soon because of the demand for very large filament-wound tanks. A spider-like machine may be possible which could be used on any size form to deposit filaments and resin and thereby create a building module.

National Cash Register has successfully used a chemical method of making flexible foam assume rigidity. In combination with an inflatable or expandable structure, this foam could serve as an on-site form for overwinding where wall thickness is desirable for support or insulation.

Summary

Reasons for further and continuing study of the filament winding process for building modules:

1. Although low in specific modulus, the fiber glass-resin filament-wound combination appears in raw and fabricated form to compete as a structural material with wood and steel on a price basis.
2. The filament-winding process is currently capable of using a machine to fabricate "module-like" structures with very low cost in man-hours as compared to present methods.
3. Very large structures can be built on-site with relatively low-cost machinery.
4. Filament-wound shapes can be very pleasing, economical in surface area and of great variety in design.
5. The materials used are resistant to weather, corrosion, can be pigmented, easily repaired, electrically and thermally insulated, can be sawn, ground, drilled, tapped, cemented, and will not support combustion.

For these reasons, the filament-winding process should be considered in the search for the totally-manufactured building module. ☐

Module Concepts Through Wood Technology

David S. Wolff

We in this country are faced with one of the most critical problems modern society could ever dream was possible. The problem is not restricted to any one specific geographic area. The degeneration and dilapidation of our shelter is extremely democratic in its process. We have substandard shelter in the intercity complex, the suburbs, as well as our rural communities. The problem of providing or replacing adequate shelter for our masses has become so critical that we are approaching an emergency position. It is probably safe to surmise that tons of paper have been consumed in reports of why our shelter is what it is. Statistics are provided that indicate the greatest need is among low-income groups, ranging from needy to destitute. Some of the "whys" indicate the low-income groups are poor credit risks for sale of new shelter. Others suggest that the landlord today only wants to milk his dilapidated structure to the last penny's rent. Others hold that cities have been lax in condemning substandard structures to force improvement, and on and on.

But what of the "hows?" Surely with all of the knowhow we possess in this country, methods can be developed to produce the "hows."

There is one possible solution: industrialized housing. By the use of an in-factory system of producing shelter, low-cost, high-quality structures can be produced in sufficient numbers to begin to satisfy some of the need. The mobile home manufacturing industry has the technical, as well as physical, capability to fulfill this need. This industry routinely produces hundreds of thousands of living units yearly that are marketed at the "retail" level through dealer organizations across the country. There are the dissenters who say the mobile home is not esthetically acceptable. Current statistics on mobile homes produce an interesting case on their behalf as to acceptance; that being, one out of five housing starts (non-farm) under $12,500 are mobile homes.

Factory-Built Wood Frame Units

But giving the dissenter the benefit of the doubt, remove the frame or undercarriage and its wheels from the mobile home, place this product on a permanent foundation, and you have real estate. This product becomes a module—a building block with an infinite variety of configurations for providing shelter. On the same production line that produces mobile homes, conventional wood frame modules can be manufactured. This industry can produce in a factory all that can be conventionally "stick-built" in the field, but with many advantages. Such advantages include controlled production flow; the use of automated equipment; electric and pneumatic, as well as hydraulic, fixtures and jigs; continuous production under a factory roof with no weather delays; mass buying capabilities; increased quality control; lower labor rates, and many others that would be found in the factory production technique.

Wood frame modules can be stacked, one on top of the other, to provide two-story town houses, apartments and garden apartments. Modules can be joined together to form single-family structures as well as duplexes.

The same wood frame nominally-sized lumber as used in conventional construction can be assembled and fastened together in the factory process,

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A demonstration project in Vicksburg, Miss., Fredella Village replaces a section of deteriorated housing (top left). The Magnolia Homes units were trucked to the site and erected in about two weeks (above). Bottom unit contains living and . . kitchen/dining areas; upper units have two bedrooms and bath, plus storage. Financing is provided by 221(d)(3) of the National Housing Act.

with the addition of adhesives, to provide structures as strong, if not stronger, than those conventionally built.

The process is that of a totally prefabricated building unit in the production line.

Floors, walls, ceilings and partitions are manufactured as subassemblies and then joined together in the production line. Wiring and electrical devices are installed at their proper time, as well as plumbing and heating. Insulation is used to meet existing weather conditions. Multi-family and single-family structures have been manufactured today incorporating gypsum wallboard interiors with plaster finishes never before used in structures of this type. Cabinets, doors, windows and hardware are all installed in the factory before shipment.

Ideally, while production of the module goes on in the factory, the site is prepared to receive it when ready, thus reducing costly delays for completion. The transportation of the module is rapid, as well as the erection process. The fact that the module has been totally completed in the factory further reduces the completion time at its ultimate site, except for the connection process of one module to another and the mechanical portion. The ultimate owner of the structure, or structures, enjoys savings in time, to say nothing of the interim construction financing charges that can be reduced as a result of the fast erection process.

The design process, through the use of modules, challenges the architect's skill.

Some Problems

There are a few disadvantages to the concept. The manufacturer is limited to module sizes no larger than 12′ wide by 60′ long and approximately 11′ in height; larger modules cannot be legally shipped over our existing highways. Structures over two stories in height cannot be economically manufactured to meet existing fire codes in many of our cities, other current problems are the unfortunate built-in resistance of many city building departments to the new, unique, and innovative building techniques, and finally resistance of organized labor against the total fabrication concept.

The future and success of the art lies primarily in overcoming the aforementioned resistance. True technological design and construction breakthroughs will be wasted, if not accepted at the city "permit" level. The industry can never flex its full muscular strength until the city rids itself of antiquated codes, recognizing the need for new and encouraging, as well as stimulating, innovation in the best interest of the existing need. □

Membership in the BRAB Building Research Institute

With the establishment of the new BRAB Building Research Institute, and with the dissolution of the old BRI, Inc. and the BRAB Associates, a new membership and fee schedule has been established for the BRAB Building Research Institute. All new applicants will be governed by the new fee schedule and on January 1, 1970 all BRI members, old and new, will use the new schedule. Application blanks for membership are available from Institute headquarters or this page may be torn out for use in making application.

ORGANIZATIONAL MEMBERS

Organizations which apply for or are invited to membership, and are approved for membership, with vote and payment of a fee, and which are allowed to nominate voting representatives appropriate for the category for approval by the Board.

Including: manufacturers and distributors of building products or materials, contractors, builders, owners, operators, managers, financiers, publishers, private research or testing laboratories; architectural, engineering or consulting firms; trade associations; schools and universities; and foreign firms.

Category 1: FEE $600; Three representatives with additional representatives at $75 each

- Companies with annual sales to building industry of over $5 million
- Contracting firms and building owners with dollar volume of construction over $5 million
- Professional firms with gross fees over $1 million

Category 2: FEE $300; Two representatives with additional representatives at $75 each

- Companies with annual sales to building industry of under $5 million
- Contracting firms and building owners with dollar volume of construction under $5 million
- Professional firms with gross fees under $1 million
- Trade associations

Category 3: FEE $150; One representative with additional representatives at $75 each

- Companies with annual sales to building industry of under $2.5 million
- Contracting firms and building owners with dollar volume of construction under $2.5 million
- Professional firms with gross fees under $.5 million
- Schools, universities and foreign firms

INDIVIDUAL MEMBERS

Individuals who apply for, or are invited to membership, and are approved for membership, with vote and payment of fee.

Category 1: FEE $75

- Architects, engineers, consultants, and employees of associations and societies

Category 2: FEE $35

- Employees of government, academic institutions and non profit agencies

Individual Memberships include all member services—the BRI journal, BUILDING RESEARCH; the Newsletter; 25% member discount on BRI publications; any technical reports that may be provided; and reduced member rate for registration at BRI Conferences. However, the membership privileges are not transferable and the membership is listed in the name of the individual only, not in the name of his organization.

SUSTAINING MEMBERS

Organizations, national trade associations and individuals which elect to become members and are approved for membership with a voluntary payment, and which accept the same benefits and conditions as apply to Category I, Organizational Members.

Category 1: FEE $1000 or more annually; Three representatives with additional representatives at $75 each

INSTITUTIONAL ASSOCIATES

Selected government agencies and professional societies throughout the building community which are invited to membership without required fee or vote, but which are allowed to nominate a representative for approval by the Board. Applications must bear the signature of responsible official.

Such representatives will receive the BRI Journal and Newsletter and will be allowed to register at conferences at the reduced member rate.

FEE: None

APPLICATION FOR MEMBERSHIP in THE BRAB BUILDING RESEARCH INSTITUTE

of the Building Research Advisory Board
National Academy of Sciences-National Academy of Engineering-National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418 — Phone 202/961-1515

Date____________________

I hereby make application for membership in the BRAB Building Research Institute in the following category:

Organizational Member	**Individual Member**
☐ Category I	☐ Category I
☐ Category II	☐ Category II
☐ Category III	
☐ **Sustaining Member**	☐ **Institutional Member**

NAME____________________
(Individual, Organization or Institution)

AFFILIATION____________________
(Required for Individual membership only)

ADDRESS____________________ **Zip**__________

NAMES OF REPRESENTATIVES (and additional Representatives):

NAME____________________

TITLE____________________

ADDRESS____________________

NAME____________________

TITLE____________________

ADDRESS____________________

Additional representatives in excess of number shown in schedule may be designated at $75.00 each per year.

If this application is approved, the undersigned agrees to pay annual dues in advance according to the dues schedule.

Check enclosed*__________ Submitted by____________________
(signed)

Title____________________

Address____________________

*Dues are payable by calendar year; if less than a full year remains at time of application, dues should be prorated on quarterly basis. Make checks payable to the National Academy of Sciences and mail to the BRAB Building Research Institute, 2101 Constitution Avenue, N.W., Washington, D. C. 20418.

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Announcing the

BRAB Building Research Institute

Spring Technical Conference

BRI

"New Towns: Frontiers or Failures?"

(Innovations or Mistakes?)

April 29, 30-May 1, 1969

Sheraton-Chicago Motor Hotel, Chicago, Illinois

Are America's New Towns serving the functions for which they were planned? Are they sociologically valuable? Financially sound? When they don't work whose fault is it? These questions and related ones will be explored at the BRAB Building Research Institute Conference. Today, New Town concepts have penetrated almost every remote geographical region in this country. It is important, in the creation of an entirely new environmental community, to study those factors which can prevent the results from fulfilling the dream and the need. Two of our most precious resources—land and time—are at stake in this largest of all building enterprises. Both the successful frontiers and the adjudged failures contribute decisively to the success or failure of all future New Town endeavors. Both successes and failures of innovations in the New Town concept will be explored by speakers at the BRI conference.

Topics to be explored in depth are:

Tuesday, April 29

Techniques of Determining Location
Techniques of Land Acquisition and Finance

Wednesday, April 30

Techniques of Land Planning and Development
Techniques of Construction and Design

Thursday, May 1

Techniques of Construction Financing
Techniques of Selling, Leasing, Renting and Managing

Experiences to provide the basis for exploration of the six subject classifications will be drawn from among the following New Towns:

NEW TOWNS FOR SUBURBIA: Reston, Virginia; Columbia, Maryland
NEW TOWNS FOR LEISURE: Snowmass, Colorado; New Seabury, Massachusetts
NEW TOWNS FOR COMMERCE: Constitution Plaza, Connecticut; Ghiradelli Square, California
NEW TOWNS FOR RETIREMENT: Leisure World Projects; Gulf American Projects
NEW TOWNS FOR INDUSTRY: McCulloch Properties, California; Aluminum Corporation of Canada
OLD NEW TOWNS REVISITED: Green Belt Towns; Smoke Rise, New Jersey

Luncheons

In order that attendees may explore subject matter with speakers, each speaker will be assigned a table for luncheon on Wednesday and Thursday. Registrants may sit with the speaker of their choice (first come, first serve basis). In addition, a nationally known figure will speak at noon on Wednesday.

Further information on the program and registration can be obtained from BRI headquarters, 2101 Constitution Avenue, N.W., Washington, D. C. 20418, phone 202/961-1515.

Hotel Reservations

All sessions will be at the Sheraton-Chicago Motor Hotel, 505 N. Michigan Avenue, Chicago, Illinois. For room reservations contact the hotel directly and mention the BRI Conference.

ADVANCE REGISTRATION

Name______________________________

Title______________________________

Organization__________________________

Street______________________________

City____________State________Zip________

Mail to:
BRAB Building Research Institute
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

New members whose application and check for 1969 dues are received at or before the time of registration may register at the reduced BRI member rate.

CONFERENCE FEE SCHEDULE

The registration fee for the conference is $35 for BRI members and $50 for non members for three days; For two days, $20 for BRI members and $40 for non members. (Luncheons not included.) Federal government employees admitted free.

Conference Only	Members	Non members
Three Days	☐ $35.00	☐ $50.00
Two Days	☐ $20.00	☐ $40.00
Wednesday Luncheon		☐ $5.00
Thursday Luncheon		☐ $5.00

TOTAL PAYMENT ENCLOSED $____________

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THE BRAB BUILDING RESEARCH INSTITUTE 1969

The Building Research Institute is a component of the Building Research Advisory Board of the Division of Engineering, National Research Council. The National Research Council was organized by the National Academy of Sciences in 1916 in order to provide for a broader participation by American scientists and engineers in the work of the Academy. The Academy was chartered by Congress in 1893 as a private organization with a responsibility for advising the Federal government in science and technology. Since this responsibility is now shared with the National Academy of Engineering, organized in 1964 under the original NAS charter, the Research Council serves, in effect, as an operating agency for both Academies.

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VOLUME 6, NUMBER 2
APRIL/JUNE 1969

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Building Research is published quarterly by the BRAB Building Research Institute, National Research Council, 2101 Constitution Ave., N.W., Washington, D. C. 20418. BRI members receive *Building Research* as a membership service. Subscription rates to non-members: $35 annually; $9.00, single copy. Special rate for college, university and public libraries; $20 annually. All subscriptions payable in advance in US funds. No discounts. Additional subscriptions or copies to BRI members or employees of member-organizations, $12 annually; $3.50 single copy.
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building science news

Architectural Programming Book Published by AIA

"Emerging Techniques 2—Architectural Programming" by Benjamin H. Evans, AIA, and C. Herbert Wheeler, Jr., AIA, is part of a continuing study of emerging techniques of architectural practice instigated by the American Institute of Architects Committee on Research for Architecture. The book includes a brief analysis of current programming practices and problems, and describes, with illustrations, some of the programming techniques currently being used by architectural offices.

The 70-page book is available from the American Institute of Architects, 1735 New York Avenue, N.W., Washington, D. C. 20006 at a cost of $2.50.

Robert F. Hastings Runs for AIA First Vice President

BRAB member Robert F. Hastings, FAIA, has been nominated for First Vice President of the American Institute of Architects. The election will take place at the Annual AIA Convention to be held in Chicago June 22-26.

If elected First Vice President now, Mr. Hastings will become President of the Institute at the convention in 1970. He would succeed Rex W. Allen, FAIA, the current president-elect who will take office during the June 1969 convention.

Mr. Hastings is president of Smith, Hinchman and Grylls Associates, Inc. of Detroit, Michigan. Formally a member of the BRI Board of Directors, Mr. Hastings has served on the Board (BRAB) since the merger in January of the Building Research Institute and BRAB.

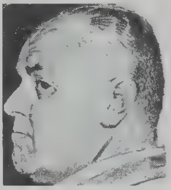
Jonathan King Elected Honorary Member of the AIA

BRI member Jonathan King, Vice President and Treasurer of Educational Facilities Laboratories, Inc. (EFL) has been named an Honorary Member by the American Institute of Architects. Mr. King has long been a supporter of research efforts in the building field, leading to improvements appropriate for educational buildings.

Among Mr. King's major activities has been the initiation of the EFL-backed industrialized school building component system. He received the American Builder Magazine Award for innovations in building in 1965.

Roger H. Corbetta Awarded Turner Medal

Roger H. Corbetta, Active Board (BRAB) member, has been awarded the American Concrete Institute Turner Medal "for Pioneering in concrete construction and more recently for promoting and implementing coordination and cooperation among the various segments of the concrete industry."



Mr. Corbetta is chairman of the Board, Corbetta Construction Company, New York. He has been identified with precast concrete structures and prestressing methods since 1920. He has pioneered in the field of thin-shell concrete construction and is one of the nation's leading concrete contractors. Through his firm Mr. Corbetta has directed a diversity of projects in many parts of this country as well as in Puerto Rico and Spain. He has visited and consulted on construction problems in Central and South America as well as in the middle eastern countries of Syria, Lebanon, Kuwait, Saudi Arabia, Iraq, and Iran.

Mr. Corbetta's outstanding accomplishments in concrete contruction have earned him many honors and many contracts. Among the well-known projects that bear the Corbetta stamp are Dulles Terminal at Chantilly Airport; Pan American Terminal at Kennedy International Airport; the Bronx-Whitestone, Tri-borough, George Washington, Tappan Zee and Rip Van Winkle bridges; Hartford's St. Joseph Cathedral; the atom smasher complex at the University of Chicago's Argonne National Laboratory, and some 18,000 apartments for the New York City Housing Authority.

One of the founders and first president of the Concrete Industry Board of New York, Mr. Corbetta served as its chairman for 5 years. He recently completed three terms as president of the American Society of Concrete Constructors. He also is a past president of the American Concrete Institute, 1963, and the Cement League of New York.

Federal Laboratories to be Used by University Scientists

The President has approved a policy directing the Federal agencies to adopt procedures to make the very valuable equipment now in use in Federal laboratories more readily available to qualified university scientists who need and can make good use of it. He directed Dr. Lee A. DuBridge, Director of the office of Science and Technology, to monitor the execution of this policy by the Federal agencies.

The President said: "The equipment of many Federal laboratories is superb and often unique. This investment should be viewed as a national resource and not one for the exclusive use of the laboratory staff members. While many scientists and engineers from universities now frequently use Federal research facilities, an even closer and more extensive cooperative relation will be productive. I am therefore approving a policy designed to bring this about. Dr. DuBridge will be able to implement the policy with the help of the Federal Council for Science and Technology, which has recommended its adoption."

ASTM Seminar Cosponsored by BRI

A Seminar on Building Construction standards will be held by the American Society for Testing and Materials at its Headquarters, 1916 Race St., Philadelphia, Pa., on Sept. 29-30, 1969, in cooperation with the Building Research Institute and the Philadelphia Chapter of the Construction Specifications Institute. It is designed for those persons in architectural and construction engineering offices and others in construction who feel they need to be brought up-to-date or be informed on the roll standardization plays in their industry.

The seminar will present a comprehensive series of talks on the applications of standards and standardization techniques to practical problems faced by those engaged in the design and construction of commercial, industrial and public buildings. The speakers will discuss soils and foundations, concrete, wood, steel, fire tests, roofing and waterproofing, and nonstructural elements. The seminar will conclude with workshops and discussions.

Standardization is an activity by which equipment, materials and manpower may be used at the highest levels of efficiency. Standardization is a vital management tool and like all other management tools it is a matter of understanding the theory and its efficient application to specific problems.

The registration fee of $85 for both days or $50 for either one of the two days is payable in advance and includes all reference materials and texts. Attendance is limited to 100 persons.

For further information contact John B. Bidwell, American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103.

Directory of Engineering Research and Graduate Study

Just published by the American Society for Engineering Education is the 1969 edition of the annual combined "Directory of Engineering College Research and Graduate Study," the up-to-date and complete guide to graduate programs at 178 major engineering schools in the United States, Canada, and Puerto Rico. All data were supplied directly by the deans of engineering and/or directors of research of the colleges of engineering having one or more curricula accredited by the Engineers' Council for Professional Development.

The prospective graduate student will find, all in one place, information regarding graduate study in every degree-granting department, including names of department chairmen, admissions officers, and research directors; graduate degree requirements; off-campus or extension programs; faculty and enrollment figures; degrees granted, listed by degree program; research areas of doctoral theses; and appointments and stipends available. No other publication contains such complete and comprehensive information.

The Directory details $246 million in engineering college research for 14,200 projects. It also covers faculty and students engaged in engineering research, areas of research, and expenditures by area. A separate breakdown of engineering-related research by other university departments is also given.

Directory information is compiled in an easy-to-read style, with tables giving breakdowns and totals for each institutional listing. Fields of engineering graduate study and areas of research are indexed. Copies of the 225-page book are available at $7.00 each from ASEE, 2100 Pennsylvania Ave., N.W., Washington, D. C. 20037. A special price of $3.50 is offered to students, if payment is made with order and name of school and curriculum are mentioned.

ASHRAE Celebrates 75th Anniversary

This summer in Denver, Colorado, those ASHRAE members and guests who attend the 1969 ANNUAL MEETING, June 30 to July 2, will help to celebrate the Society's 75th Anniversary—seven decades of technological progress in heating, refrigeration, air conditioning and ventilation. Formal recognition of ASHRAE's achievements will be highlighted by Presidential Member Daniel D. Wile, Los Angeles, Calif., who will review the history of the Society and its impact on industry.

Approximately 75 papers will be presented at the four Technical Sessions and 10 Symposiums during the three-day Meeting at the Denver Hilton Hotel. In addition, there will be seven off-the-record Forums.

Symposiums and forums will feature: Performance of Variable Air Volume Systems; Progress Report II—Task Group on Energy Requirements; Variable Capacity Pumping; Refrigerated Warehouses—Insulation and Design; Centrifugal Heat Pump Systems; Human Factors; Hospital Air Conditioning; Construction Industry Arbitration Rules; Air Pollution; and State-of-the-Art Development in Heating and Air-Conditioning.

Technical Session papers vary from Fireplaces and Their Chimneys—Fundamentals of System Design; to Model Skin Temperature—An Index of Thermal Sensation in Cold, Warm, and Humid Environment; to Heat Transfer Properties and Characteristics of Appalachian Areas "Red Delicious" Apples; to An Experimental Check on the Weighting Factor Method of Calculating Room Cooling Load.

President William L. Holladay will report on the Society's activities at the Monday Welcome Luncheon on June 30 and Officers for the 1969-70 fiscal year will be installed during the Banquet on Tuesday evening. The new President, now President-Elect, will be William G. Hole, Montreal, Canada.

UNIQUE PROFESSIONAL OPPORTUNITY—Join The BRAB Staff

The Work: BRAB staff professionals serve as technical and administrative backup to the various committees of BRAB; the work includes assembly of technical information for committee members and then translation of committee deliberations into final reports.

The Challenge: BRAB undertakes activities and studies relating to the total science and technology of building; as a result, BRAB staff professionals are called on to serve committees addressing a very wide variety of problems.

The Advantages: Work on the BRAB staff offers professionals a unique opportunity to assist leaders in all segments of the building industry (Government, private, and academic) in solving some of the most timely and interesting problems facing the industry and the country.

The Requirements: Applicants should be graduate engineers or architects with demonstrable writing ability, at least three years of professional experience in building-industry related work, and a desire for broad experience in this field.

To apply, send resume and salary requirements in confidence to **Robert M. Dillon,** Executive Director, Building Research Advisory Board, National Research Council-National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D. C. 20418

(An equal opportunity employer)

building science news (Continued)

Computerized Information System Developed

A computerized information system that will allow architects to retrieve data on building products and materials meeting specified performance criteria will be developed for the New York State University Construction Fund by McGraw-Hill Information System Company.

The system, believed to be the first of its kind, will make the task of selecting building materials more efficient and economical for architects who must meet the state agency's goals of achieving quality architecture on time and at reasonable cost, according to Dr. Anthony G. Adinolfi, Construction Fund general manager.

The Construction Fund is a public benefit corporation established in 1962 by the New York State Legislature to manage the planning, design, construction and financing of facilities on 30 State University campuses. It is responsible for an expansion program that will approach $3.5 billion through 1975.

The need for a comprehensive product information system has become increasingly apparent during the past several years, according to the Construction Fund general manager.

Prior to the first phase of actual system development, the Construction Fund and McGraw-Hill will work closely with architects, manufacturers and contractors to determine the critical requirements of the information system users, and, in a broad sense, to parameters and characteristics of the overall system necessary to provide the required service.

Wood Foundation Studied

A new all-wood foundation system, designed for installation in all-weather conditions, is being used in three Lexington Park, Md., homes. The builder, Cliff Homes, of Lexington Park, will erect the third house next week using the new foundation system. The house is being fabricated by Kingsberry Homes, Inc., Atlanta, Ga.

The all-weather foundation system, using treated wood members and treated plywood sheathing, is being built as part of a cooperatively sponsored industry-government research study to provide technical breakthroughs with applications to all types of residential housing programs. Sponsoring organizations are the National Forest Products Association, American Wood Preservers Institute, and the Economics and Marketing Division of the Forest Service, U.S. Department of Agriculture.

The technical study is being closely followed by the FHA which has backed the loan commitment Title 223 of its experimental housing program. The NAHB Research Foundation, Inc., Rockville, Md., is conducting the study for the sponsors and will follow industrial engineering techniques.

7 Days Required For Research VIII Using Components

Six days for construction and one day for installation was the time it took for production of NAHB Research House VIII, built to demonstrate economies of off-site fabrication, components and sectionalized techniques in meeting housing needs of low-income families.

Built in the South Bend, Ind., plant of Andrew S. Place, chairman of NAHB's Research House Subcommittee, the house was started on March 3 and completed March 8. The three sections were trucked to the site at 1530 E. Donald St., South Bend, on Monday, March 10, "and by 5:15 p.m. everything was finished—the heat was on, water running, telephone connected, appliances operating—in other words, a family could have moved right in," Place said.

Research House VIII was framed conventionally of components—roof trusses, floor and wall panel subassemblies.

The house will remain on display for an indefinite period until it is sold.

calendar

June 2-4—Convention, Construction Specifications Institute, Houston, Texas

June 11-12—Symposium on Non-Destructive Testing of Concrete and Timber, Institution of Civil Engineers and British National Committee for Non-Destructive Testing, London, England

June 16-19—Annual Meeting, American Society of Landscape Architects, Chase Park Plaza, St. Louis.

June 22-25—Annual Convention, American Institute of Architects, Chicago, Illinois

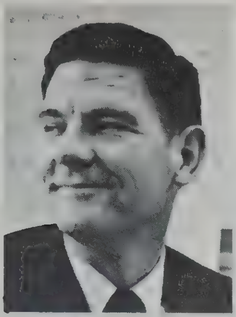
June 22-27—Annual Meeting, American Society for Testing and Materials, Atlantic City, New Jersey

July 6-10—Annual Meeting, Forest Products Research Society, Sheraton Palace Hotel, San Francisco, California

July 9-12—Annual Meeting, National Society of Professional Engineers, Muehlebach Hotel, Kansas City, Missouri

re-searching

by **Benjamin H. Evans, AIA,** *EXECUTIVE SECRETARY*



Still the New Look • One of the most important things to any organization, in fact, to the entire society, is the ability to change and adapt to the changing needs and demands of the times. History books are full of accounts of decayed countries, organizations, societies and even individuals which were somehow not able to adapt to change. The current period has been dubbed by many as the Period of Change and is likely to leave behind more dead organizations than all previous history.

Those of us who have believed so steadfastly in the worthwhileness of BRI have resolved that the Institute will not be one of those organizations which does not change and respond to the needs of the day and the days ahead. As that resolution takes tangible form, there will be some changes that work well and some that will not. The ones that do not work will be dropped by the wayside. We can, therefore, expect BRI to be a dynamic organization.

The Journal • As you have no doubt noticed, *Building Research* has adopted a new style and format. The purpose of the change was simply to make the Journal easier to read and more attractive to the eye. Your letters will tell us how well we have succeeded. In coming months we hope to enlarge upon the Journal's mission to be a medium for scholarly research papers and to print some of the kinds of building research papers that are not usually printed in the popular magazines. We intend to seek other mechanisms for publishing proceedings when appropriate, and to a greater degree use the Journal for transmitting results of building research activities.

Those who have significant research papers dealing with housing, building, environmental design and related areas are urged to send them in for review. No guarantee is made, of course, that they will be published. Acceptance is the prerogative of the Editor, based on quality, appropriateness and timeliness.

Organization • Ed Schreiber, who is now Chairman of the BRI Operating Committee, and as such, is the "guiding light" of Institute actions, has sought to adapt new methods for BRI operations. He has restructured the Operating Committee to function in an administrative capacity, establishing direction, planning action and assigning members to specific tasks. Peter B. Gordon will act as Vice Chairman and Marvin K. Snyder as Secretary.

Schreiber

Gordon

Snyder

The MEMBERSHIP PROMOTION COMMITTEE will be responsible for advice on publications, including the Journal, Newsletter, conference proceedings and other special publications; for publicity on conferences, workshops, symposia, and other activities; and preparation of a membership campaign to promote new members and spread the word about the value of BRI. Cochairmen are William R. Reardon and Anthony Vilar.

Reardon

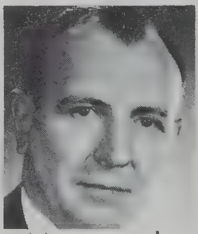
Vilar

The PRODUCTION PLANNING COMMITTEE cochaired by Robert M. Engelbrecht and Alan Green, will be responsible for an ongoing study and analysis of potential areas of interest to the Institute and for evaluation of ideas generated within the Technical Committees and outside the BRI membership. The committee will in no way override or supersede the Technical Committees and the programs instigated by them. It will, however, attempt to keep an eye on the broader aspects of industry needs and recommend programs of action not likely to result from T.C. activities.

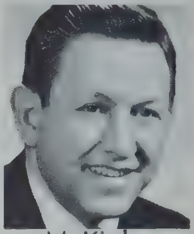
Engelbrecht

Green

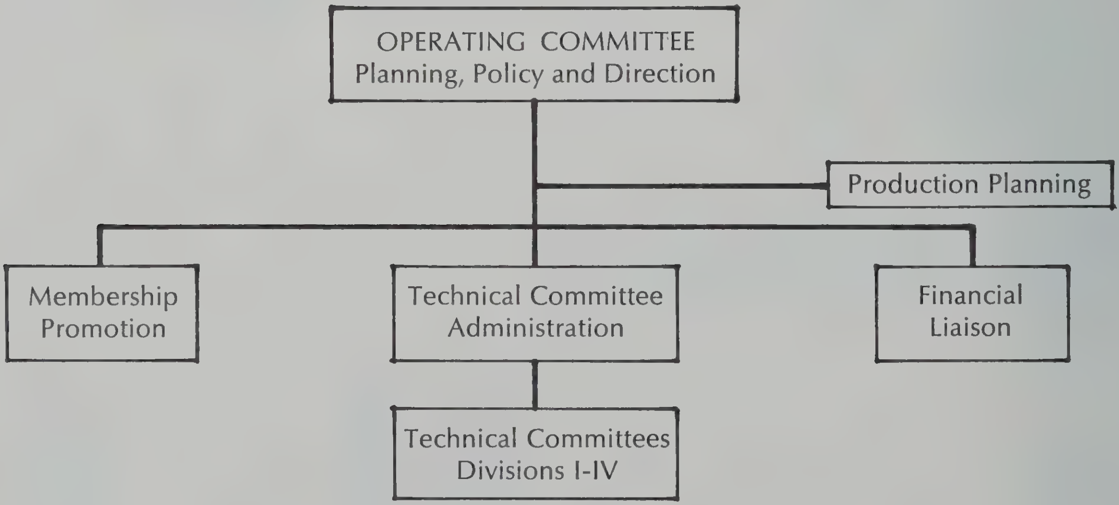
The TECHNICAL ADMINISTRATION COMMITTEE is to be responsible for organizing and stimulating the development and continued action of the Technical Committees. This is an administrative function and cochairmen Dan Morgenroth and N. M. (Nat) Martin will be calling upon other BRI members to assist them in the development and staffing of the committees. It is expected that every BRI member will soon be assigned to one or more committees.


Morgenroth

Martin


McKinley

Robert W. McKinley is chairman of FINANCIAL LIAISON and is responsible for recommendations and advice on financial matters and serving as liaison with the Board (BRAB) and its Institute Affairs Committee. Continued alertness to ways and means for increasing Institute income will help ease the burden of inflation. BRI is, as most membership organizations are, operating on nearly the same dollar-per-member base as it was ten years ago.


OPERATING COMMITTEE
Planning, Policy and Direction
Production Planning
Membership Promotion
Technical Committee Administration
Financial Liaison
Technical Committees Divisions I-IV

Annual Meeting • Plans for the annual combination BRAB/BRI Fall Meeting are in process so mark your calendars tentatively for October 23-24. You will be hearing a great deal more about the meeting in coming months. This is the time when BRAB/BRI invites friends from government and industry for a special social occasion and for exploration of selected technical problems. ☐

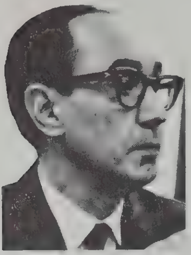
BUILDING DESIGN PROGRAMMING

Buildings are costly, complicated machines. If they are to perform as other machines—jet airplanes, nuclear ships, cotton gins—they must be designed efficiently and appropriately for the tasks they are to perform. Too frequently, rooms in buildings sit idle, expensive fixtures are used only occasionally, costly appendages require constant maintenance and planned traffic patterns become obsolete. Good functioning requires good building design programming.

There was a time when a few notes on the back of an envelope adequately described an owner's desires and a building's functions. But society has become so much more sophisticated with regards to the multiplicity of functions to be housed that adequate facilities must now be very carefully and systematically described before proper planning can begin. The process of building programming is fast becoming recognized as one of the most important elements in environmental design and it rightly deserves considerable attention.

In May of 1967, The Building Research Institute organized and conducted a workshop on Building Design Programming with some twenty specialists in attendance. The revealing thing at the meeting was the lack of communication that had previously existed between these people with such common interests who were, for the most part, unaware of the existence of the others. The enthusiasm of the group for further discussion prompted a 1½ day session at the 1967 BRI Fall Conferences in Washington, and a follow-up session at the BRI Seminars in Anaheim, California in September of 1968.

The original workshop and 1967 Fall Conference session were organized by Ben H. Evans, AIA, Chairman of BRI Division I, and then Director of Education and Research Programs for the American Institute of Architects. The Anaheim Seminar was developed and moderated by Gerald Davis, Director of Building Program Associates, San Francisco, California. The following papers are those presented at those BRI sessions. ☐



Organizing for Programming

by

William M. Peña, AIA

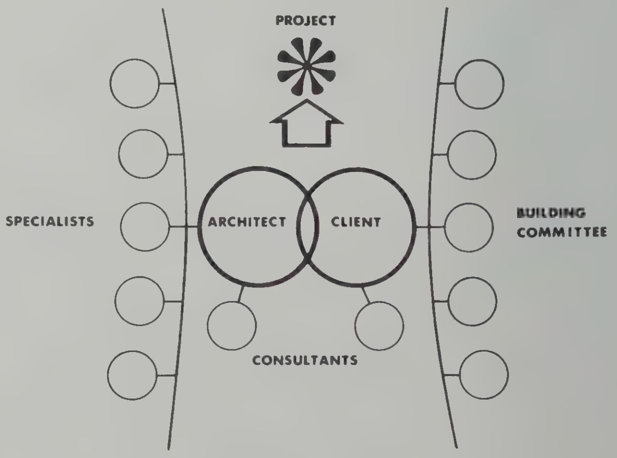
Good programming is dependent upon an organized process. But establishing a routine need not mean getting in a rut. The security of a framework within which to work can allow for innovation and for exploration of alternate parts.

A better name for programming is "architectural analysis." In programming we seek the uniqueness of the problem—new and unusual relationships—and thereby operate at a level of creativity. The approach to programming then should be analytical, creative and (as we shall see) cooperative.

Each architect must determine his own goals for programming and know how these are meshed into his design philosophy before he can organize his programming process. The process itself can be the same for any building type. Needless to say, the more complex the project, the more comprehensive the programming must be. Computers are being used as aids in programming complex projects. But perhaps the best contribution to programming from the computer field has not been in the ability to handle huge amounts of data, but in clarifying the need for an orderly, logical approach. One cannot really believe in the future importance of computers without becoming an advocate for sound programming. Programming is the input to design. How then should we organize for programming? I will cover five points in general and then a five-step process which seems logical to me.

1 **Obtain a background.** One of the goals for programming should be to identify and to understand the nature of the problems. To start, develop a background for a new building type through library research and conferences—read, talk, and listen. Visit plants with similar functions. Seek out problems, not solutions. With enough background information one can determine the number and kinds of consultants which will be required and when they might be most useful.

2 **Organize an architect-client team.** It is important that the architect and the client each designate a responsible person with complete authority to make decisions. Only in this way can communi-



It is important that the architect and the client each designate a responsible person with complete authority to make decisions.

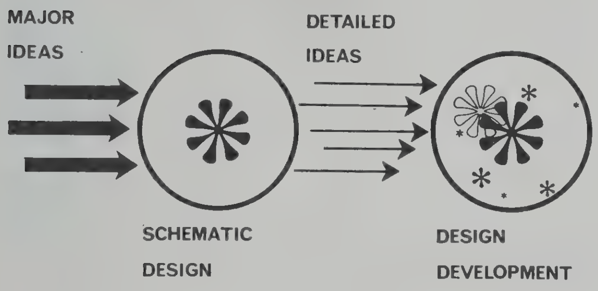
William M. Peña is Partner and Director of Programming for Caudill, Rowelett, Scott, Architects-Planners-Engineers, Houston, Texas. A member of the American Institute of Architects, Mr. Peña graduated from Texas A. & M. College and is registered in Texas and Kansas.

cations be effective. With the client on the team you can have the advantage of group interaction. The team concept involves not only the architect and his staff of specialists and consultants, but the client coordinator, his committees and consultants as well.

3 **Develop effective communication techniques.** To be effective, the team concept requires a high degree of communication. Start by assuming that a typewritten page does not communicate as easily as a diagram. Try to diagram every pertinent fact, every concept; rely on the written word only as a last resort and in this case reduce each thought to a succinct statement. A good idea or an important fact cannot be discussed and evaluated unless it can be expressed clearly to all concerned.

Use "think" or analysis cards with an opaque projector—each presenting only one thought, one fact, or one concept. Use "brown sheets"—the graphic representation of the space requirements drawn on brown wrapping paper. The relative sizes and number of spaces on brown sheets help the team grasp their significance quickly, and more easily. Specific space requirements can be discussed in the context of the total space program and can be seen at a glance or two.

4 **Plan on a two-phase process.** Programming is a two-phase process which provides the appropriate information for the two-phase design process.

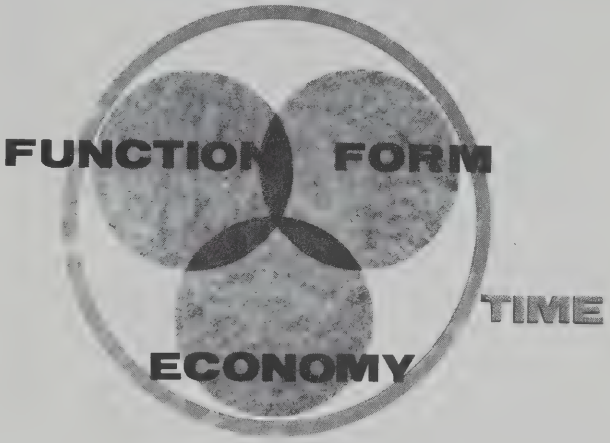


Programming is a two-phase process which provides the appropriate information for the two-phase design process.

The schematic program corresponds to schematic design; the program development to design development. Schematic design stems from major ideas and facts which should not be diluted by the flood of details to follow in the program development. For the first phase, learn to discriminate between pertinent facts and details. Establish a hierarchy of facts and ideas. Simplify and clarify them.

5 **Distinguish between content and procedure.** It is essential to understand the difference between the basic considerations as the content and the system procedure which is the heart of the programming process.

We must still depend on the triad of Form, Function, and Economy as the source of information. And we must superimpose the fourth consideration of Time over the triad. Under Function we consider aims, methods of achieving them, and people.



Form, Function, Economy and Time are basic considerations, but not in themselves a process.

Under Form we consider the site, the physical and emotional environment, and the quality of space and construction. While Economy may indicate primary concern for the initial budget, it must include consideration of long term and operating costs. Under Time we investigate those aspects (past, present, and future) which affect Function, Form and Economy. But Form (emphasis on site), Function (functional program), Economy (cost), and Time are not in themselves a process, although we can use them as criteria in evaluating the programming at any stage and particularly the schematic programming package.

The programming process is a simple procedure which ends (not begins, as in the typical scientific method) by defining the problem which must be solved through design. We can elaborate later on this procedure, but it is important now to state the five basic steps:

1. Establish aims
2. Collect, organize and analyze facts
3. Uncover and develop concepts
4. Determine needs
5. State the problem.

An evaluation of the results of the first four steps will lead to the statement of the problem. Theoretically this is the end of schematic programming. A sixth step (now fully in schematic design) would be the investigation of alternative solutions. A seventh step would involve the evaluation of alternative solutions and the eighth would represent the solution itself. Now to discuss each of the five steps.

1 **Establish Aims.** The client will usually blurt out the aims for his project in the very beginning when he has the total project in mind, but we usually fail to record this and thereafter we lose this information. He may articulate his aims in terms of the program, the site, the budget and time. We must train ourselves to be alert to catch this information or to ferret it out.

Sometimes the client may have a conflict between his own aims and the methods that he wants to use to achieve these aims. When this happens the programmer must employ all his talents and techniques to help the client resolve the conflict. It is important to establish clear-cut aims.

2 **Collect, Organize, and Analyze Facts.** Facts by themselves will tell us nothing. They have to be organized and analyzed before they will reveal their relative importance and meaning. Here we have to discriminate between pertinent facts and details. Otherwise, we will be overwhelmed by details and confusion will set in. We do not want to stop the flow of information, but we must not let the details cover that which is real in planning. Hence, the idea of two-phase programming.

Many kinds of facts will be required.

We need to process facts regarding the numbers of people and their activities to be housed now and in the future. We need to determine the spaces which will be required.

We need to collect, organize and analyze all the facts dealing with the site. Remember that the site can be a great form-giver, considering not only the physical, but also the legal and spiritual aspects of the site. We need to summarize the important aspects of codes and zoning ordinances, of coincident planning.

We need to ascertain the source and amount of funds, local construction costs, and the line-item components of the total budget.

3 **Uncover and Develop Concepts.** Step 2 is said to deal with facts and Step 3 with concepts. However, it is difficult sometimes to separate facts from ideas. For example, the organizational concept of a school may involve the house plan, but this may be derived from the need for the decentralization of large numbers of students. The numbers are facts. The house plan is a concept. They depend on each other.

We must test our program with a series of recurring concepts such as the concept of centralization versus decentralization. We must find out which services are better centralized or decentralized. Such services as library, administration, dining, guidance, greatly affect a school's social organization.

We must find out if activities should be integrated or compartmented—another concept test. A family of activities would indicate integration—the need for some kinds of privacy, compartmentalization.

We must test the concept of flexibility and find out which aspects of it apply—expansibility, convertibility, versatility.

Under the concept of hierarchy we can find a series of questions regarding the order of importance, such as relative position, size, social value, and so forth.

Above all we must look for concepts derived from the physical, social and emotional characteristics of people—as individuals, in small groups, and in large groups.

4 **Determine Needs.** One of the most important steps is to balance the space program with the cost budget. There is no question about it, if we do not determine the realistic space needs (as opposed to pie-in-the-sky wants) during programming we will be working with an untenable program throughout the whole planning process and this leads to waste of time and money. If program cuts are indicated, they must be made at this time.

The "brown sheets" are most useful in communicating with the client during this time. They must be considered as worksheets, allowing for additions and deletions of space, until agreement can be reached on a definite space program for which funds are available and which the client must approve. Later the corrected and approved brown sheets can be reduced in size photographically for table use by the designers and the client.

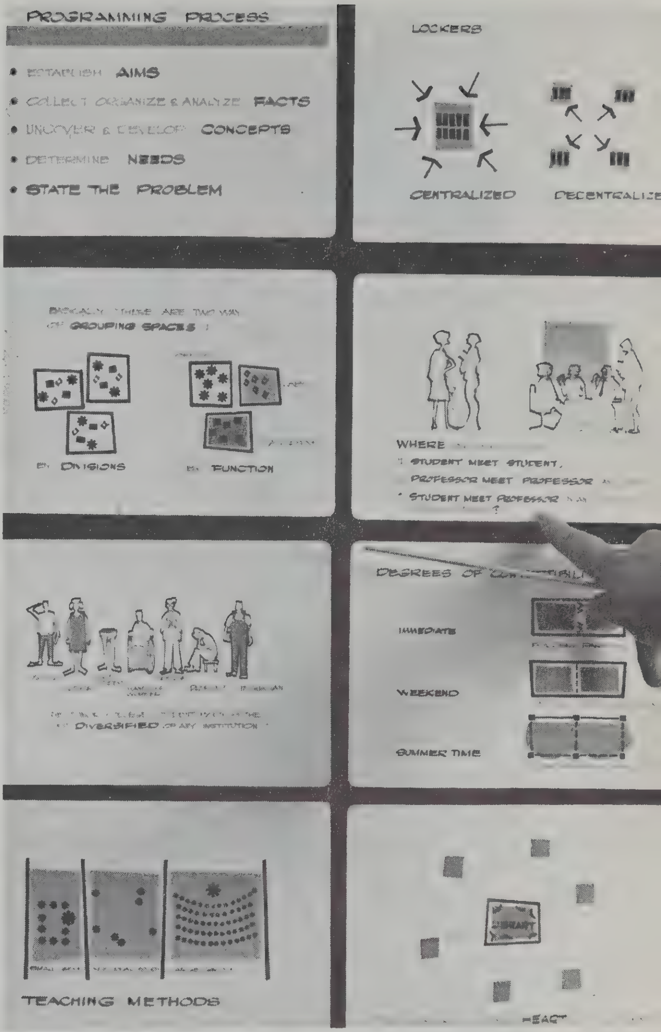
We must continue to refine our space-cost parameters to establish realistic budgets. Allowance must be made for a reasonable building efficiency (the predicted relationship of net to gross areas.) The building cost is based on a cost per square foot and percentages of building cost may be used for most of the other line items of the budget unless more refined figures are available. Most often these are based on the architect's experience tempered by the local situation.

5 **State the Problem.** Now we are ready to state the problem—to find the uniqueness and the essence of the problem. After evaluating all the information derived from the previous steps, the programmer and the designer together must arrive at the most important statements that can be made regarding the problem. There should be a minimum of four statements concerning the program, the site, the budget, and the time. There should be no more than ten statements. More than ten might indicate that the job is very complex or that we are resorting to details as premises for design. These statements should be made in terms of performance and not of specific physical form. They should be made so as not to close the door to different expressions in architectural form.

COST ESTIMATE ANALYSIS BLANK JUNIOR COLLEGE

DATE: 25 OCTOBER 67 REVISED__________

A. BUILDING COST	**315,500 S.F. a $20.00/S.F.**	$6,310,000
B. FIXED EQUIPMENT	**(8% OF A)**	504,800
C. SITE DEVELOPMENT	**(20% OF A)**	$1,262,000
D. TOTAL CONSTRUCTION	(A + B + C)	$8,076,800
E. SITE ACQUISITION		300,000
F. MOVABLE EQUIPMENT	**(20% OF A)**	$1,262,000
G. PROFESSIONAL FEES	**(6% OF D)**	484,600
H. CONTINGENCIES	**(10% OF D)**	807,600
J. ADMINISTRATIVE COST	**(1% OF A)**	80,700
K. TOTAL BUDGET REQUIRED	(D+E THRU J)	$11,011,700



Above, Space-cost parameters must continue to be refined in order to establish realistic budgets.

Right, "Think" or analysis cards used to more effectively communicate one thought, fact or concept.

The following statements tend to lose their relevance since they are presented here out of context; nevertheless, these actual examples may illustrate the kind of statements that might be made.

PROGRAM "This building's primary function is to serve as an adaptable, multi-purpose auditorium for the performing arts. The house should be adaptable to changes in the requirements of audiences of 1800 and of 3000 seats. The stage should serve a variety of performances." These three sentences supplemented by others based on the needs of the artist and the concert or theatre goer make up the essence of the problem regarding function.

SITE "Since the structure will occupy its own block, it should be handsome on all sides." This premise does not dictate *how* it should be accomplished.

COST "Economy means simplicity and clarity. It deals not only with construction costs but also with visual economy." Since the designer may have different projects under way, we must establish an attitude towards the budget of the project at hand.

TIME "The campus must grow. There should be visual unity at *each stage* of development."

I've described one way of organizing for programming. Needless to say, there are many other ways. Architects differ widely in their approach to architecture. To some, programming on an organized basis is sheer heresy. They prefer to rely more on intuition rather than on methodology. To others, the problem-solving approach and the team concept make sense. ☐

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Architectural Programming Practices

by

Benjamin H. Evans, AIA

Society, today more than ever, is racing through time poorly making decisions, giving the wrong answers to questions and/or making no decisions at all. Almost any of the specific problems we face today could have been avoided by careful thought a few years or decades ago.

You've probably heard of the systems group that made a study of the social situation in California and pinpointed Watts just days in advance of the outbreak as a point of potential unrest. Such analyses are not simple, of course, but the point is that careful thought, study and analysis is a process which we frequently neglect and which has the potential of providing tremendous economic and social progress. We all have a tendency to want not to have to make hard decisions—we would rather someone else would do it. We do not want to have to study and think. I remember reading a statement by one of the great philosophers which went something like this: "Most people think only once or twice in their lives. I make it my business to think once or twice a month!"

We have only to look around us at the buildings we work and live in, at the streets we drive on, at the governments that govern us and so on to see that there has been a lot of non-thinking in the past. We can also see that in what we have done we have pursued questionable goals.

Goals

Is the goal to have two cars in everyone's garage? Or is the goal to get people from one place to another with convenience, safety, and ease? Is the goal to provide shelter from the elements for our families? Or is the goal to provide an environment for enrichment of living? Is the goal to provide health centers that will prevent sick people from dying of disease? Or is the goal to help sick people to return to society with healthy minds and bodies? The establishment of proper goals is absolutely essential and yet we try so hard to avoid spending the time and energy necessary for developing them.

Architects and owners have much too frequently made decisions with regards to buildings without any real study of their future or present needs. Because they were usually dealing with historic building types, they knew somewhat intuitively what would suffice to meet the particular functions of that already well established pattern of activities. We all used to know what had to go into a school. We used to know what had to go into a hospital.

Even with all the new functions that buildings have to accommodate today, we still find we are able to adapt some old buildings and spaces to fit the new needs. That we are frequently able to do so, somewhat conceals the fact that in thousands of other cases, buildings that are structurally sound are being torn down because they cannot be adapted to serve the new needs. It may be impossible to plan and design the environment so that it can always effectively and efficiently respond to changing needs, but good planning will certainly result in environmental spaces better suited to future needs, and much less prone to financial obsolescence. The process for doing this planning is commonly referred to as "programming."

Program criteria

Programming in this context is defined as the process by which criteria are developed for the design of a space, building facility, physical environment and/or any unit of the environment. The term in its generic sense can be applied to any planning of future procedures, but here it is used

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Benjamin H. Evans is Executive Secretary of BRI and Assistant Director of BRAB. He was previously Director of Education and Research for the American Institute of Architects and was Associate Professor and Director of Architectural Research at Texas A&M University. Mr. Evans was formerly a member of BRAB and a Vice President of BRI.

only as it applies to architecture. It is the means through which data about the needs of the ultimate building user are expressed for the instruction of the architect in the development of the design solution.

Such a program of criteria will include all of the characteristics, or functional requirements, expected of a given activity to be housed, and may include aesthetic, spiritual or other esoteric considerations that may, or should, influence the decision making process. The program usually will be stated in a written report, but that report itself is not the program; it is a statement of the program at some particular point in time. Programs are not definitive objects, but continuing processes which seldom if ever reach an absolute. Program statements continue to change and recycle through the planning and design process.

There is often confusion between different disciplines about the term programming, and indeed, this difference of definition or interpretation often leads to serious problems. Educators, for example, often refer to the development of space requirements as "educational specifications" whereas the architect considers this as programming. The architect considers "educational specifications" as the statement of philosophy and objectives, whereas the educator refers to this as program.

Programming Elements

What term is applied to these necessary studies is not so important, of course, as the understanding of the range of elements included, so that all concerned parties can communicate. There are at least four principal segments to a program statement:

1. Client background and research:
    - Organization structure
    - Growth projections
    - Economic base
    - Labor market
    - Population distribution
    - Community characteristics
2. Philosophy and objectives:
    - Goals, Methods, Aspirations
3. Space Requirements (as based on)
    - Personnel growth projections
    - Activity programs
        - Man to man
        - Man to machine
        - Machine to machine
4. Functional relationships between:
    - Administration
    - Divisions, Departments, Services,
    - Community, etc.

The development of a program covering these items is generally considered the responsibility of the owner—it defines his problems and his resources. And while he is usually assisted by an expert who knows how to do this, it is at the owner's expense.

This expert, most frequently a member of the architect's team, must be involved in the planning from the very beginning and must work closely with the designer-architect so that the designer can be thoroughly familiar with the reasoning behind program decisions.

Program Instrument

From this information, the architect can then develop his program instrument which generally includes the following:

1. Objectives of the master plan
2. Special restrictions and limitations on design (codes, zoning regulations, etc.)
3. Characteristics of the site
4. Site development requirements
5. Functional requirements for the facility
6. Characteristics of the occupants
7. Specific facility requirements
8. Relative location and inter-relationships of spaces
9. Budget—including long-range operation costs
10. Flexibility for future growth and changes in function
11. Priority of need among the various requirements

There are, however, differences of opinion as to what specific elements are normally included in programming. Master planning, for example—the planning of broad elements that usually precedes the planning of a specific facility—is certainly an important input for programming, but is generally considered separate from what is commonly called programming. Feasibility studies, financial analyses, and site analyses are likewise sometimes considered part of programming, but most often they are not.

The importance of understanding the lack of consistency in the use of the term is that clients and architects alike must be alert to the fact that they must be sure to understand each other's intentions when discussing programming or negotiating a contract.

The value of good programming is manyfold. It clarifies the intentions of owner, user and designer before planning is begun. It reduces the necessity for changes during final design, development of construction documents, and, construction. It provides a basis for arbitration should differences occur. It also serves as an agreed upon reference point which will facilitate control of future change. It reduces the chances for wasted space, excessive equipment, and poor relationships between parts.

Techniques Survey

For the past year, I have been working on a study of architectural programming for the American Institute of Architects which is intended to uncover emerging techniques of programming practices. In my reading and interviews, I have encountered several major recurring problems.

1 Communications

The most common concern seems to be with the difficulty of maintaining good *communications*. There is, as previously mentioned, the lack of common understanding of the term programming and what it includes. If we don't understand each other's word meanings we can't very well communicate. There is also the problem of getting at the client's or user's real desires—of getting him to think through and clearly express his intentions. There is the communications problem of the owner's understanding of what services he can and should expect from his architect and consultants—of understanding the architect's capabilities and motivations—of understanding why the architect wants to discuss and incorporate certain aesthetic or subjective elements whose value can't be clearly or definitively stated. There is the problem of the programmer clearly communicating his findings to the designer. There is the problem of the architect communicating the basis for his design decisions to the owner in order that the owner may see and understand clearly what his finished facility will be like and how it will respond to his needs.

Unless the elements of communication are resolved, problems will arise, the job of planning and design will be more difficult and less effective and the cost of design will increase.

2 Problem Definition and Hierarchy

Architecture has always been considered a problem solving process. But as one of my professors used to say, "you can't solve the problem until you know what the problem is!" Often times, with today's complex technological development, it is exceedingly difficult to determine what the real problems and issues are, prior to execution of a design. In any design effort, there are usually many problems to be solved, some of major dimensions and some very secondary. Very frequently, it is difficult to determine which of the problem conditions is most important and therefore most likely to have a major influence on the final form of the facility. Quite often a client states what he feels are the most pressing problems only to find later in the planning process that these were not the real issues after all. Failure to detect the *essence* of the problem at an early stage leads to wasted expenditures of energy, time and finances and sometimes results in a weak, confusing and inefficient design.

Architecture and architects are most often criticized for what is left out of a facility rather than what is included. This is because the average person, and indeed client, has little comprehension of the hierarchy of decisions which must be established somewhere in the design stage.

It is extremely difficult in the programming stage to develop a hierarchy of design items that presents the total range of problems in such a way as to allow easy evaluation. It is difficult to decide, for instance, whether good circulation at a higher cost with inexpensive A/C is more worthy than a just-adequate circulation pattern and a very sophisticated air conditioning system. It is difficult to decide whether funds should be devoted to aesthetic considerations in a health unit when there are not funds for the needed beds. Decisions about the hierarchy of elements will depend on careful study, a thorough understanding of goals, and close consideration between client and architect.

3 Fact Collection

The collection of facts pertinent to the design of a new facility would seem at first glance to be a simple problem. Of course, it isn't. Anyone can collect facts, but the trick is to collect the right facts, to avoid useless data, and to organize and present these facts in a sensible order. Extraneous data only tends to confuse the issues. It has been said that the cost of compiling trivia is high, and that the cost of analyzing it is even higher.

Some programmers approach fact collection in a rather casual way, hoping that their intuition will lead them to the significant problems without too much wasted energy and effort. There are notable examples where such procedures have succeeded. But for most of today's complex functions, such as a mental health facility, laboratory, or office building, a more systematic approach by programmers would seem to be valid and necessary. The more systematized approach helps avoid the possibility that important items may be overlooked, and more especially, helps protect the client from his own natural tendency not to face the uncertainties of the future. Also, it has been observed that the greater the depth of knowledge established by a program, the greater the opportunities for design expression. Sometimes architects tend to feel that facts get in their way, but I've never seen a case where knowledge didn't pay off in increased creativity.

On the other hand, there is sometimes a danger that questionnaires, forms and the systematic approach may tend to limit and restrict the inquisitiveness of the programmer so that he may overlook something of importance simply because it has not appeared in a previous job. While questionnaires and forms are very valuable as evaluative tools, they cannot compensate entirely for a creative attitude on the part of the programmer. Indeed, clients might be well advised to select an architect for his capabilities in programming, as well as for design, due to the importance of this decision making process.

Experience in the planning of a particular type of facility is another area of growing concern. There was a time when it was not considered necessary for an architectural firm to have had experience with a particular building type in order to design one. A fresh and uninhibited approach was considered quite essential for a fresh design. However, again in terms of today's complex functions such as a health facility, experience is a commodity without which an architect simply cannot effectively function. Such experience does not always have to be a part of the architect's permanent team. When the architect encounters a particular facility he has not encountered before he can call for help from a consultant who does have the necessary experience. This is what makes up the "architectural team"—a group of experts. In the big firms, each of the necessary talents is frequently a permanent part of the team. In a small firm, the unusual talents are brought in for a specific job. The problem, is that the range of talents needed is continually expanding and in order to make best use of these talents a systematic process seems to be necessary.

4 Fees and Services

Perhaps the most frustrating problem connected with programming is the matter of compensation and services. Various architectural firms provide various services for various fees which sometimes tends to confuse the client. It shouldn't, for after all, most business operates this way. However, it is essential for a client to know what he is getting and what he is paying for. According to the AIA-B131 document, "Standard Form of Agreement Between Owner and Architect," detailed programming is over and above normal services and the regular fee. This is prompted by the fact that programming can be very simple for some building types and extremely complicated for others resulting in differing cost. On the other hand, most architects feel that programming is such an important and integral part of the total planning process that they do not like to separate it from the total package.

Probably the best solution to this dilemma is for the client and architect to agree on what needs to be done and what resources will be required and then for them to negotiate their contract accordingly. Clients may get burned, however, if they coerce the architect into doing the programming at no additional cost. The results are likely to follow the old adage, "penny wise and pound foolish."

5 Research, Testing and Evaluation

While programming includes a great deal of fact gathering, it also inevitably includes some prognostications or downright guesses. Such predictions are based primarily on past experiences. Architects know from previous experiences that some things work and some things don't.

Such experiences, however, usually come primarily by chance. Sometimes a previous client or user will complain about some facet of a facility that doesn't work properly. As the architect collects such complaints and attempts to determine the causes, he builds up an accumulation of knowledge of things that do and don't work. There seems, however, to be a growing tendency for architects and owners to systematically study their finished products to determine whether the original decisions, or programs, are performing as anticipated.

A truly thorough evaluation of a program and design is, indeed, quite complicated in most cases, and though owners and architects are reluctant to finance such studies the need is becoming acute. There have been a few attempts in recent years to develop standard procedures by which building designs can be evaluated, but by and large, very little systematic post-construction study takes place. Thus, we seldom know whether or not our design decisions were, in fact, the best ones.

There is a real need for more research and for development of simulation techniques that will allow design evaluation during the planning stages. Several such techniques are being developed by researchers around the country. A group in Seattle is studying the use of 3-D photographic techniques for simulating spaces. There is also study on the use of optical methods for observations of the inside of scale models of proposed designs. There are studies in progress to find ways by which computers can be used to pre-test spacial arrangements and movement patterns. The computer is already being used with an occiloscope to visually present a moving image of a proposed design.

Such research and simulation techniques will undoubtedly prove extremely useful in the future, but there is still a great need for careful and systematic evaluation of full sized facilities in order to build a storage of experience and knowledge. It's the responsibility of both architect and client to see that such studies come about.

After studying techniques of programming—the successes and failures—for the past year, I have arrived at a personal conclusion. The reason that there are so many very bad buildings around the country is that there is not enough good quality programming going on. The architects and owners are not giving enough importance to programming planning. We must work together toward the improvement of new techniques for collecting, analyzing and evaluating data for the betterment of all society. ☐

The Independent Building Program Consultant

by

Gerald Davis, AIA

The identification of building programming as a separate discipline, and the formation of specially qualified teams to do this work, is such a recent development that the responsibilities of the programmer are still being defined. For me, the programming function is perhaps clearer than may be the case for those who do programming work within an architectural office. Although I am an architect, the firm of which I am a part is engaged solely in the professional practice of programming buildings. We study the present operations and future plans of a company or public authority, and specify what kinds and numbers of buildings and facilities it will need at particular periods in the future. We then prepare instructions for the architect who will design the buildings, and we consult with owner and architect during the design process.

We have found these three activities—research, planning, and consultation—to be the main entities of programming. **Research** includes *Activity Analysis,* or determining what kinds of activities will be served by the proposed buildings, and analyzing the ways that these activities affect the form of the buildings; and *Quantitative Analysis,* or determining the extent of the activities, and the numbers of people, animals, equipment, or other goods to be accommodated at different future dates. **Planning,** or consolidating the research and synthesizing it so as to produce two kinds of printed material includes; a statement of objectives and policies for confirmation by the owner, and, a set of instructions, which serve as guidelines for the architect. **Consultation.** I have come to realize that the success of a program hinges entirely on my success in communicating with the architect. I cannot simply give him a book of instructions. As the architect develops the design, he will almost certainly uncover conflicts between design and functional goals, and these questions must be settled so as to more nearly achieve both sets of goals. The owner must also be made aware of the questions so that he will know and approve of any tradeoffs in values. Further, when the buildings are complete, we consult with the owner as to future use and modification.

Activity Analysis

Although a variety of skills and techniques are required to obtain the information we need, especially in view of the many types of buildings on which we work, the method central to all of them is that of systems analysis. An office building requires somewhat different types of programmatic research from an airport, which, in turn, is different from a hotel, and so forth. Yet in the research for each of them, we find common methods of gathering data and putting that data into meaningful form. An example may help to make the method clear.

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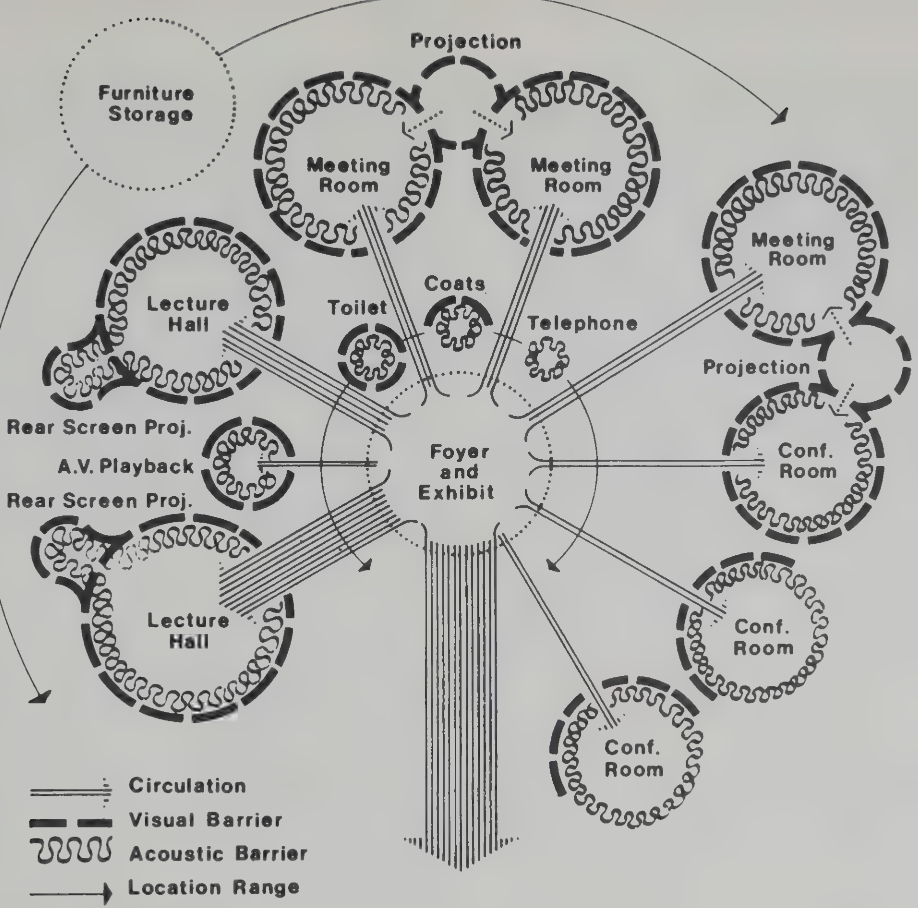


Space Diagram.

In preparation for the expansion of a rapidly growing university, the dean of students asked us to study the way in which the design of college housing affects student study patterns. There being no significant published data on the subject, we had to start practically from scratch. We consulted housing officials and others concerned with the problem, and reviewed our own earlier interviews with students from a prior project before we even planned the research.

For the pilot phase, we chose some eight campuses on the basis of reputed excellence of residence facilities or programs. At each campus, an interviewer, experienced in college student personnel work, tape-recorded a series of discussions with selected students, administrators, and others. The original questions asked were based on our prior work, but were modified as the project progressed. At one of the campuses, cooperating faculty and students obtained over a hundred depth interviews from a carefully chosen sample.

After many hours analyzing the tape transcripts, depth interviews, observation reports, and building plans, we felt ready to plan the major part of the study—an analysis of the way in which people actually study in college housing.

Depth Interviews

To determine the advantages and disadvantages of various sizes of suites and living units, we planned depth interviews on these subjects at several campuses. Special depth interviewing was necessary at two campuses where integrated living-learning centers had been established. The data from the student interviews had to be correlated with measurements and other physical descriptions of student rooms. Students living in certain dormitories at three campuses were to be asked to keep activity logs, focused on their academic pursuits, over a brief period. This data was to be machine-tabulated and plotted, and correlated with other research data from the same campuses. And finally, we decided to station trained observers at several dormitories to record student activities in common facilities such as study and typing rooms.

Prediction Accuracy

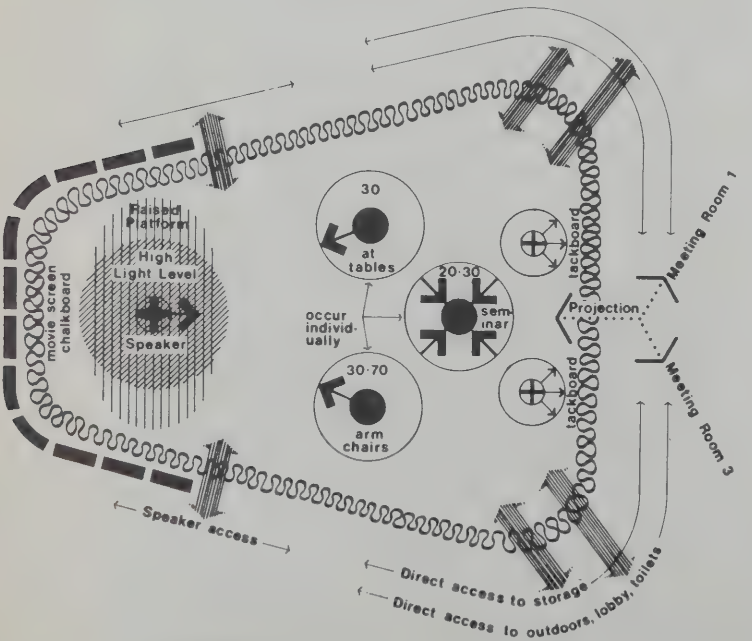
We were well aware that architecture had a powerful effect on student activity. We had learned from our earlier study that the design and layout of dormitories affected student friendships as much as or more than the personalities of the students themselves. We found that we were able to predict with an accuracy of plus or minus one room per floor, in which rooms would live the students who would have the most friends.

The analysis and correlation of the research into a form usable for building programming is time-consuming and demands both skill and insight. It may take as much time as the gathering of the data itself. The programmer must be concerned not only with objective facts, but also with subjective values, which reflect the way people feel in and respond to the architectural environment. Matters of cultural difference, such as the way in which people from different backgrounds, or different national origin, obtain and use privacy, or have different standards for personal distance or territoriality, can strongly affect the way a building works. We have found that the understanding and skills of the anthropologist can make an important contribution to the program in this respect.

Our research is not always so esoteric as that for the project just mentioned. But even for more prosaic matters, the challenge may be as great. The office space needed by the accounting department of a manufacturing company, for instance, may be very different in organization and physical relationships from that of a marketing organization or an insurance company. It is the responsibility of the programmer to determine the owner's need for individual offices and for large and small secretarial work areas, and to determine the probability or partition rearrangement in future years. The number of secretaries to be grouped together, and the proximity requirements between them and executives, vary from company to company, and from time to time. The architect must be instructed to provide for the range of probable requirements. With them in mind, he can design in as much flexibility as is really necessary, with better resulting cost control.

Quantitative Analysis

The nature of the activities determines the type of building; the extent of activities and the interrelationships of sub-activities, determines the size and number of the buildings. The methods of systems analysis are brought into play here. For example, we were asked to program facilities for a biological research center in which the growth of some research groups were determined by management's judgment, as it interpreted the goals of the company and the achievements of the individual units, while the growth of other units, such as the analytical service group, depended almost wholly on the workload generated by the research groups. We made a mathematical model of the company, in which the relationships between the groups and other limiting factors, were stated in numerical form, and we solved equations for various probable rates of growth of the independent units. Naturally, management had something to say about these growth projections, but as it developed, the company accepted our estimates as reasonable extrapolations from its own more general statements of objectives and from sales and budgetary projections, and authorized us to use our figures as the basis for sizing the facilities.



Space Diagram.

The plans for the animal holding rooms for this company are an example of the fine line between programming and architecture. We did not specify to the architect a proposed optimum bay or room dimension. Rather, we proposed a range of animal colony sizes which were desirable for functional reasons and suggested approximate square footages needed to house these colonies.

It occurred to the proprietors of an enormous underground parking structure near a mass transportation facility that they might well use the airspace above the garage for a modest hotel of perhaps 160 rooms. They asked us to determine if such a structure were indeed feasible and, if so, what size it should be.

For this project, we needed information related to the needs of travelers, and to the economics of hotel operation.

We were experienced in gathering the first type of data and we embarked with our normal procedures, interviewing travelers as to length of trip, nature of trip, length of stay in the city, and so forth. These answers were computerized for ease of analysis. We also conducted depth interviews with business managers and others who might use the hotel, and obtained information useful in differentiating the economic projections for this particular hotel from the experiences of other hotels in the area.

To get information on wage scales, food costs, and the like, in the city we brought in an accounting and management consultant firm which could provide the data directly from its own files and which could help us to relate the research data to the economic projections. (In the final report, this firm's contribution was clearly identified as a separate section, so that credit and responsibility could be clearly assigned.) As it developed, we found that the hotel was not only feasible, but should indeed be much, much larger than anything the client had considered.

Electronic data processing can play an important role in such research. The advantage of the computer is that it allows quick and easy correlation of data and, further, through the use of mathematical models, allows us to test quickly for a variety of assumptions and expectations. In particular cases, it may let us identify those departments for which a small change in size or workload could result in significant changes elsewhere in the company.

We find that the determinations of size and the analysis of activities must be conducted simultaneously, because the results from each will strongly affect the results from the other. Indeed, in our interim reports during the pre-architectural phase, we frequently find that we must include tabulations of site population projections, or similar material, with our recommendations about space requirements and facilities.

Policy and Objectives

From the analytical data, the programmer derives a statement of the owner's policy and objectives. It is almost inevitable that different levels in the client hierarchy will have conflicting objectives and where these conflicts could result in conflicting programmatic requirements for physical facilities, the programmer must seek clarification and resolution. These conflicts may bear on such fundamental matters as the size of the new facilities, or the direction or expansion of different sections of the client organization. Or it may be at a more detailed level such as the conflict between management's desire to provide food service or sufficient quality and low enough cost so that key staff members will eat in (instead of going out for lunch preceded by two martinis), and the desire of the food service department to "look good" by keeping food costs down.

Agreement on policy and objectives is essential. For the architect to begin work with policies that may be changed, is to invite waste. The process of resolution may reach several levels of management in the client organization, with the programmer sometimes caught in the crossfire, but one of the advantages of programming is that it uncovers conflicts before they are translated into buildings.

Defining the Architect's Assignment

The programmer must organize his research so as to present it to the architect in a form that will be meaningful to him, and helpful in specific terms. The architect needs some of the early information for use in preparing a site development plans. More detailed information is needed later as he approaches the schematic design of the first increment of construction and starts to determine the size and form of the elements, including building and bay modules. Later still, he will need detailed descriptions of the characteristics of each space, as he progresses into working drawings and specifications.

For the site master-planning, three kinds of information are most useful to the architect: general descriptive information about the activities and the building types they require so that he can make some plausible assumptions about the scale and form that the building units will take; tabulations of the amounts of each type of building that will be needed at various periods in the future; and some indication of the requirements for proximity or separation between the organizational units.

As the architect develops the site plan, some of his conclusions may radically affect the work of the programmer, particularly when there are existing buildings whose occupancy and use must be provided for by the program. In a recent report, we offered three possible plans for the use of an existing building, because site circulation, land contour, and building form affected the decision as to which activities were left in existing structures and which were housed in the new buildings.

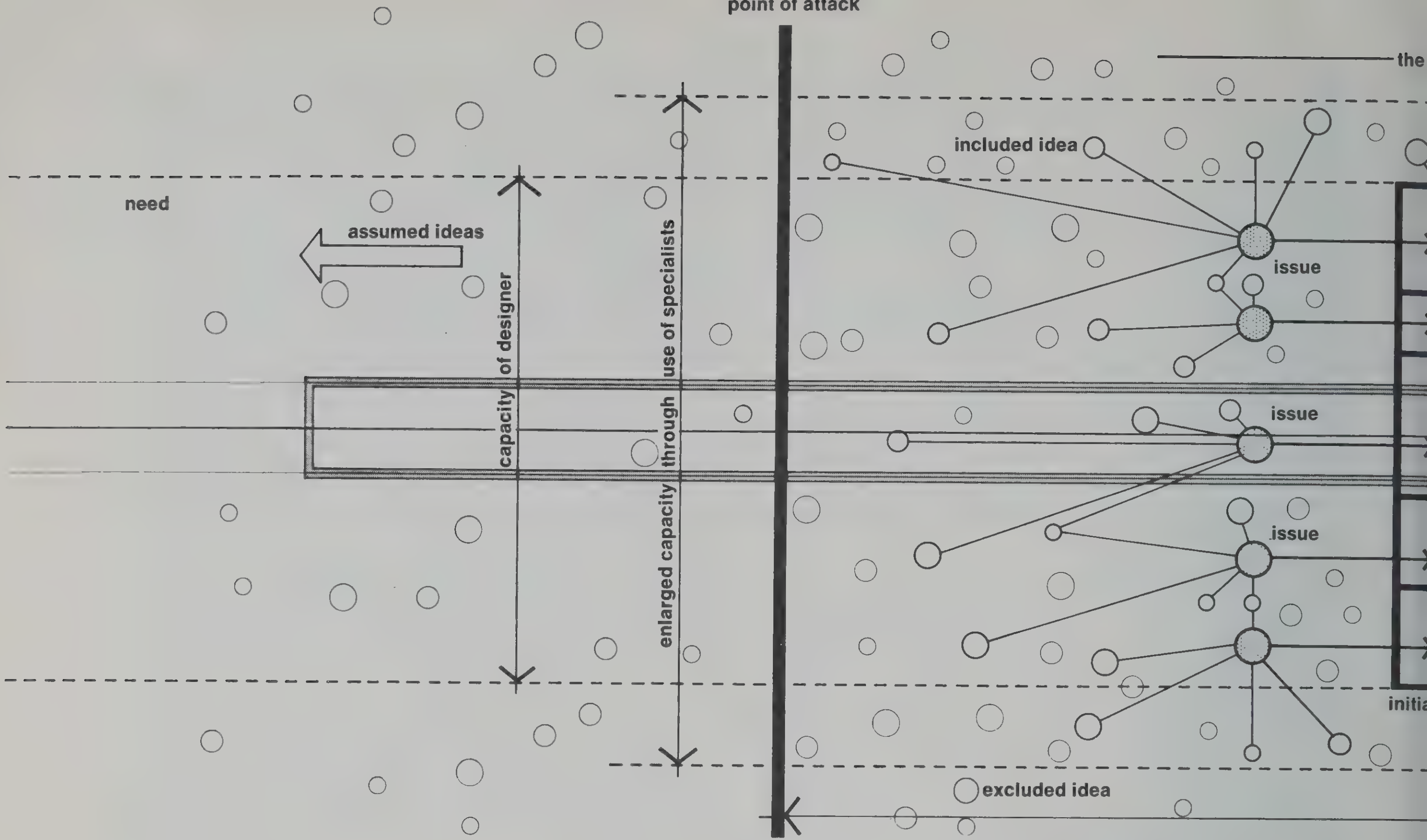
Program Summary of Spaces

Once the master planning issues are clarified, we prepare a Program Summary of Spaces, a tabular recapitulation summarizing for each group of spaces some nine types of general information, such as identification of activity, users, equipment and furnishings, interrelationships or proximity requirements, and so forth.

We try to summarize the proximity/separation requirements in diagramatic form, without drawing pseudo-floorplans. It is difficult, but necessary, to show only the relationships required and to avoid showing as "necessary" those particular relationships or dimensions which are, in fact, open to the architect's discretion. Given this freedom, the architect will occasionally ask to see any plan studies we may have prepared for internal use in testing our text and diagrams. Exposure to this background work does not seem to inhibit the architect at all.

Throughout this work there is a continual joint consultation by programmer and architect with the client and the program summary pages and diagrams are reviewed in detail with the several levels of operating staff in the client organization. Tabulations of spaces by types and department, together with related cost estimates, are kept current as the program is modified and revised in a continuing feedback process. (As soon as an architect is selected, we ask that he assume the responsibility for estimating construction costs.)

Once the program summary of spaces, with its related diagrams and cost estimates, has been approved by the owner and reviewed by the architect, we prepare a more detailed document—the program outline of individual spaces. Here we give the same nine categories of information, in much greater detail, for each of the major or typical spaces to be constructed. We generally do not describe in detail simple spaces such as coat-



The design process is represented as an open ended line, reading from left to right. The left hand portion is concerned with the abstract ideas defining the many aspects of need for a building; the right hand portion is concerned with the reality of the finished building solution. The line is open ended because the conceptual need for a building will vary in definition from problem to problem; also the finished building does not constitute an end to the problem. As a continuing living system,

rooms, or other service spaces.

Continuing Consultation

As the architect starts his schematic designs, the programmer should "crit" the drawings for programmatic issues; for there will be many new questions raised in the course of architectural design to which, even though he may not have made explicit reference in his formal documents, the programmer will know the answer. The programmer cannot transmit everything he knows about a project to the architect and even if he could, the architect would probably have neither the time nor the interest to review it all. On one project not yet completed, for instance, we have accumulated some 1,800 pages of single-spaced transcripts of interviews, all indexed by subject.

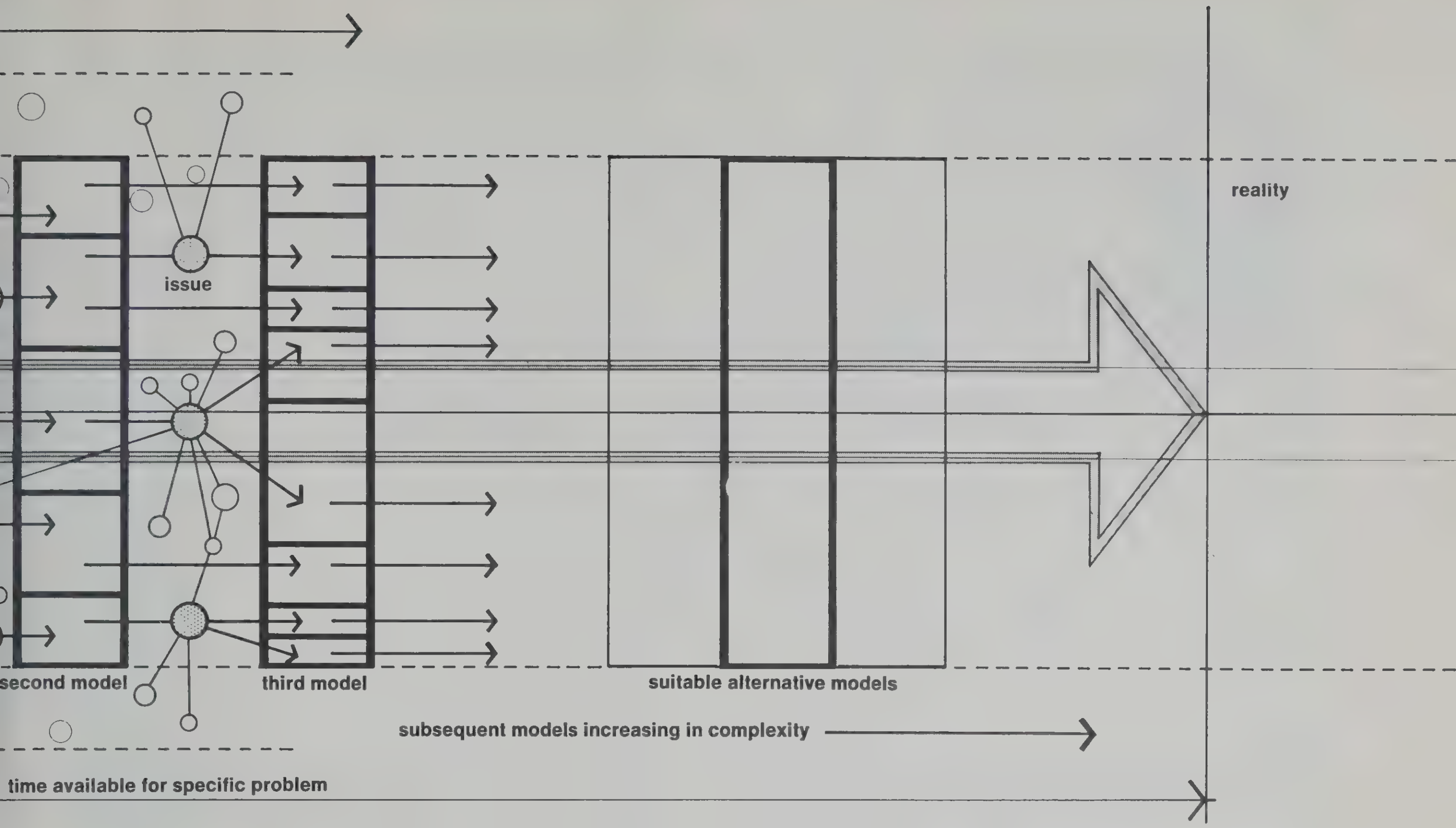
We also find that the architect raises issues requiring further research. In the schematic design for an airport terminal, the architect decided to use ramps at certain crucial locations. He lacked data, however, from which to determine the necessary width of these ramps. Additional research, in the form of observation and simulation, was necessary to determine the number of passengers per minute which could and would use the ramps, and thus to determine how wide the ramps had to be.

The programmer's work does not end with the completion of the architect's contract documents for construction. The new facilities may include innovations in relationships, and provision for activities which are new to the client organization. As the client occupies his new buildings, we may be called upon to consult in the furnishing and equipping of new spaces and with the scheduling and organizing of activities. When the new facilities are in full use, we have evaluated the way they work and the manner in which the users take advantage of their potentialities. Still later, when expansion or replacement becomes necessary, we have evaluated the ways in which the next generation of facilities can be improved based on experiences with the existing ones.

A Delicate Relationship

The programmer has a foot in two camps. He is in the difficult position of having simultaneously to function as part of the owner's team, evaluating the architect's work on the owner's behalf, and making him aware of those instances where programmatic requirements have been slighted, and, as an adviser and consultant to the architect. Sometimes the architect will propose relationships or forms by which he can achieve certain spatial or esthetic effects, or economies of construction, provided that programmatic requirements are relaxed. Here it is particularly helpful if the programmer is qualified as an architect so that he can evaluate the architect's proposal meaningfully and advise the owner constructively.

My own experience is that programmer and ar-


reality
issue
second model
third model
suitable alternative models
subsequent models increasing in complexity
time available for specific problem

it will interact with its users through time.

In a specific design problem, it is the task of the designer to translate the elements of the left hand portion into elements on the right.

chitect usually come to a joint recommendation. I have never had a case of a head-on collision.

I do not know of a "best" way to arrange the contractual relationships between the three parties. I have worked directly for owners and as a consultant to the architect. I have even had both relationships on different phases of the same project. What is important, however, is that the programmer, like the architect, have direct and ready access to the owner. If this access is used with judgment and good manners, it should raise no problems.

Qualifications

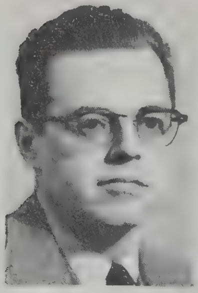
I believe that it is important that the head of a programming team should be an architect. Personally, I do not possess all of the talents and knowledge required in all three phases of programming, nor do I think it likely that any one man will posses all of those talents. The leaders of a team should have varied backgrounds and, in addition to architectural experience, should have skill in the research methods mentioned and experience in management. The team should also include specialists, either within the firm, or as consultants, according to the nature of the job at hand. Experts in operations research, in market and consumer research, in business management and financial analysis, and in anthropology, sociology, and psychology, may all be needed from time to time. Consultants specializing in a particular building type or in a particular kind of work may also be needed to speed or strengthen the programming.

How Much Does it Cost?

The standard A.I.A. form of agreement between owner and architect (B-131) specifies that the charge for programming services is in addition to the fee for basic architectural services. The amount the owner pays for programming is small compared to the architect's fee and is trivial compared to the total cost of the building.

In my firm the size of the programming fee is based on the amount of work to be done and is not related directly to the construction costs. Depending on the owner's preference and on the extent to which the amount of work can be accurately predetermined, the fee may be set on an hourly basis or it may be a fixed amount. When we are unfamiliar with the client and his activities, we prefer to prepare a limited preliminary study and then write a proposal for the first major section of the job.

The three phases of programming—the gathering and analysis of data, the derivation of a statement of policies and a set of instructions to the architect, and the continuing consultation—can justify the cost through their contribution to the final product. With its systematic approach, programming takes the art out of planning a building, and supports the art of designing it. ☐



Building Programming at Wayne State University

by

Douglas R. Sherman

At Wayne State University we view programming as a facility definition, a translation stage or interpretive step between the requirements of facility users on the one hand and the work of the facility designers on the other. To be useful, any program written for any purpose needs to meet at least two criteria. First, it must be couched in resultant terms—students served, equipment housed, processes undertaken, services provided, and so on. Second, the entire document must constitute a sort of "end use criterion" against which any plan or proposal can be rigorously evaluated in rather detailed fashion.

From the above definition, it is perfectly clear that programming is not only a vital and communicative translating step, but more importantly, can be applied to the full range of physical development. It is not going too far to say that we have, in fact, programmed our entire campus using programming techniques and that our long-range physical development plan is, in reality, such a program. Similarly, but on a less grand scale, we program the long-range physical needs for an entire discipline such as Engineering, Physical Education and Athletics, or Medicine. More commonly, however, we utilize these techniques in the development of a program for a specific building or other facility.

Programming Principles

Because the techniques and principles utilized are common regardless of the task which is undertaken, I would like to concentrate on our techniques in the programming of a specific building. Here, I think, the principles are most easily grasped and the procedures most easily followed.

Douglas R. Sherman is Director of the Office of Capital Programs at Wayne State University in Detroit, Michigan. His responsibilities include programming for all university buildings.

The programming methodology which we have utilized is, we believe, an effective one for us at Wayne State University. While we believe it to be adaptable and while it has, in fact, been reviewed by many groups, it is nevertheless tailored to our specific situation.

The Office of Capital Programs at Wayne State University is a vertically integrated administrative element. Unlike operations at many other universities, we not only project the capital and physical requirements of the University, but must secure the funds to fulfill these needs, program the facilities, work with the designers in their planning, let the contracts, supervise the construction, evaluate the results, and along the way pay all bills as these may be due. Hence, the programming operation as such is tailored to this specific set of circumstances and is but one part of our overall responsibility.

Leadership

A word ought also to be said concerning "leadership" in the programming operation. A professional staff person from our Department of Facilities Development is assigned to each project at the time a serious proposal is submitted. This man is responsible for this project throughout its entire development from a preliminary program to the evaluation of the completed building. He is primarily responsible for the programming, works with the architect during the planning of the facility, and serves in general as the project manager. We also require that a building coordinator be appointed from the group we call the "building user." This building coordinator may or may not be the head of the user group, but in any event, he serves as a sort of project manager from the standpoint of the building user during this same life of the project. We have found this kind of relationship between the administrative staff of my office and the academic departments or colleges to be an excellent one in almost all respects.

Our programming operation consists of a three step technique. First, a statement called the "preliminary program" is written. This is followed at the appropriate point in time by the "detailed architectural program." The operation concludes with a step called "program validation."

1 The Preliminary Program Statement

As mentioned previously, the preliminary program statement is prepared at the time that a specific building or other physical development is seriously proposed. This preliminary program document must "tell the story" of exactly what is proposed and why it is needed. Essentially, it has two objectives: First, to provide the necessary back-up information to help us "sell" the facility in question; second, it must provide appropriate detail so that a rough cost estimate can be made for budgetary purposes. To accomplish these two objectives, we believe that a preliminary program document must contain four elements: (1) An academic justification of the project, (2) A summary of the required facilities, (3) An analysis of impact, and (4) The concept of priority.

Academic Justification Almost any argument which can be advanced to justify a given project at a university falls into one of three broad classifications: First, the alleviation of sub-standard conditions; second, the need to meet the challenge of enrollment growth; third, the need to improve the program by adding new elements.

The alleviation of sub-standard conditions is generally considered to be the strongest argument and is usually documentable. In this connection, we not only use facts and figures but at times have even resorted to pictures.

The need to provide for increasing enrollments merely relates to a linear growth factor in the department, college, or our total university, and here again the argument is a strong one, for as a public institution we do have a real responsibility to educate the young people of our state.

The argument for new programs can at times be exceedingly strong, but often it is based more on the wishes of a department or college than on the real needs in the most basic sense of either the State or the university. Here, therefore, care must often be taken.

The Facility Summary In this part of the preliminary program document, we try to present in an outline sense the major academic areas in the project, their breakdown into complexes and sub-complexes and, finally, the specific laboratories, lecture halls, and individual rooms. Our objective here is not to present a room analysis as such, although this usually occurs. Rather, we want this facility summary to give an "arms around" feel of the entire project, emphasizing such things as student stations, faculty stations, room use, and general academic thrust.

Analysis of Impact Often, this is the most important aspect of this document, because it takes the summary of facilities and relates the impact of these additional student stations, research labs, or other facilities into the total framework of the university. The University, the State of Michigan, and the Federal Government all need to know exactly what the facility will do for us. With care, this analysis can be made in exceedingly accurate fashion and the impact can be predicted with some confidence.

A Concept of Priorities It goes without saying that the number of dollars requested is not necessarily the number which is provided. Further, building costs can skyrocket, the actual architectural plan may not be as brilliant as one would like and, in short, there are many factors which might require deletion of some or much of a proposed facility. Such deletions or cutbacks can cause real difficulties later on.

To avoid future problems, we require as a part of this preliminary program document that the building user assign priority levels to the various elements in the facility summary. After all, when a project is little more than a proposal, our professors can be very open minded about what kinds of things constitute priority-one, what are priority-two items, and what might even be relegated to priority-three or -four. Later, however, a sense of "ownership" encompasses the proposed facilities and it is far more difficult to approach the problem of cutbacks and the concept of priority in the same unemotional way.

Because of the nature of the preliminary program document, we recommend that it be written by the building coordinator in cooperation with our project manager. Such co-authorship has given us the necessary breadth of approach without the difficulties of a typical committee.

2 The Detailed Architectural Program

In discussing the detailed architectural program, I would like to begin by reviewing the two basic dimensions which the document must bring into focus, move on to organizational matters, relate our programming approach, and summarize the programming of an individual space.

Two Basic Dimensions In the broad sense, there are two aspects to the detailed architectural program—the directive and the accommodative. The directive aspects relate to what we know and what we can project in a specific sense—the "is," the "will be," and the "for sure." Because in this directive sense we are smarter today than we were last year or five years ago, it behooves us to write this detailed architectural program as late as we possibly can and still be consistent with the construction schedule. This makes our program statement as consistent with advanced thinking as it can be.

The accommodative aspect is a real foil to the directive dimension, for we need to somehow provide adequately for equipment that no one has invented, courses that no one has constructed, and research no one has even thought about. This accommodation to the future is absolutely critical—even more critical in my judgment than the directive aspect—for it is these kinds of things which render a building obsolete and the planning null and void.

The directive aspect should insure that a building is up to date at the time it is completed. The accommodative aspect should insure it stays that way.

Organizational Matters In preparing this detailed document, we utilize the organizational structure previously reported—our project manager works with the building coordinator of the building user. Academic questions are funnelled through the building coordinator; administrative and development questions are funnelled through the project manager. It is not too strong a statement to say that the degree of effective partnership which these two people develop determines in a large measure the success of the total undertaking.

Our project manager, in cooperation with the building coordinator, is responsible for meeting with all concerned persons, outlining what needs to be done, acquainting them with our various space and facility standards and, in general, providing an adequate orientation. Both men are active throughout the programming effort and are meeting and working with concerned persons on all levels. They must be ready, willing, and able to be at the same time both lubrication and power source.

While cooperation is the rule of the day, it is understood by all parties that our project manager backs up all plays, for, in the final analysis, the real responsibility is his. This "hands on" policy has paid off and is best illustrated by the difficulties we had some years ago in getting academic decisions made on schedule. Sometimes we could not get them at all. We, therefore, issued a directive that if such decisions were not forthcoming, we would make them ourselves. The interesting result has been that academic decisions are now made on schedule by the appropriate people. We have never had to make such an academic decision since the directive has been in force.

Our Programming Approach Personnel involvement underscores the entire development of the detailed program, for we maintain that the persons who are actually going to use given spaces are the ones who ought to program them. Hence, we recommend that laboratory assistants, for example, program their preparation rooms; that secretaries program their offices; and that students handle such uniquely student areas as study lounges.

Administratively, we suggest that the building coordinator assign programming responsibilities to the various senior professors who would be in charge of specific academic areas. In turn, these senior professors distribute programming responsibilities among their subordinates. Hence, the responsibilities fan out in a broadening and downward pattern until they do, in fact, involve graduate assistants, secretaries and junior staff and students. The results of these efforts for individual spaces are funnelled back through the various levels where they are reviewed and integrated until the entire building, completely programmed, is in the hands of the building coordinator. While this is a time consuming process, we have found the results well worth the effort. Not only are we involving particular experts with reference to each space, but more importantly, each of these recommendations is subjected to review on a more or less continuous basis until the program document itself is approved.

We can liken the above academic programming to a "vertical input" since it builds from specific requirements for small spaces into the total academic program. There is, however, a sort of "horizontal input" as well which is overriding and all-inclusive in a certain sense. Maintenance and custodial services, handicapped personnel and security provisions are all good examples of such "horizontal inputs." From the standpoint of operations, these, too, are critical and require close attention. Fortunately, the carryover from one project to another is substantial so that standardization is entirely in order. In the case of requirements for the handicapped, we have actually prepared a separate release which is made a part of all program documents.

Programming an Individual Space The basic problem can be summed up as follows: First, the need to ascertain relationships; second, the need to size the spaces; third, the need to identify necessary utilities; fourth, the need to list unique requirements; and fifth, the identification and resolution of critical factors.

The relationship question is broadly based, for on the one hand you must identify specific room relationships such as a preparation room to a laboratory or secretarial area to faculty offices. On the other hand, you must insure that major complexes relate properly to other major complexes and that all manner of flow problems (sterile processes, animal handling, etc.) are logically resolved. It should be pointed out that the very nature of the vertical academic input and the horizontal input of others tends to insure that such relationship questions are raised and are resolved.

As we see it, the size of any given space is determined by the number of persons who occupy the space, the things they do, and the things they work with. Hence, for each room or specific space we ask the people involved to be very specific about such things as student stations, equipment, and the nature of the operation. We go so far as to require specific catalogue numbers in the case of fixed equipment items such as laboratory benches. We do not permit, for all practical purposes, a professor or any of our staff members to provide square footage estimates. The layout of a specific space we feel to be the province of the designer, and while we will carefully review his layout and check his plans against our estimates, we want him to design a specific space in terms of the things that are happening and not in terms of someone's square footage opinion.

Utility requirements and utility locations can be a problem. We have even had chemists forget to ask for gas! If proper attention has been paid to listing the necessary fixed equipment as mentioned above, the job is easier, for with each piece of equipment can be recorded the utilities required. If such a procedure is followed, difficulties are minimized and the location problems generally resolved.

Unique requirements usually relate to such things as environmental conditions, floor loading, and electrical shielding. With a little experience, a skilled programmer can identify possible problem areas and make sure that nothing has been overlooked.

Identifying and resolving critical aspects takes real skill. Let me give an example. Typically, the utilization of an undergraduate laboratory is tied to the storage of student equipment. Typical laboratory benches provide only for three to five student sections; hence, a laboratory planned in such a way is limited in usefulness and stands idle much of the time. In our recent science buildings, we have separated the storage function from the laboratory bench and have provided separate drawer storage areas immediately adjoining each laboratory. Each student goes to the storage area, gets his drawer, and places it in the laboratory bench when his section is scheduled. Thus, instead of using a laboratory for minimum periods, we are able to have them in scheduled operation for 48, 50 and even 60 hours per week. This means that for a modest additional expenditure, we are able to achieve the effect of two laboratories designed under the older approach.

The end product of these efforts should be a document of which all are proud. Incidentally, we have found that distributing such a document to all "contributors" is an excellent move in terms of both morale and review. Board members, deans, donors, and governmental agency personnel are also good recipients, for an impressive document can be first-class public relations.

3 Program Validation

We recommend that as a first step the designers validate the detailed program by reviewing each aspect with its author. During this validation step, we involve the building coordinator and our project manager only if problems develop, for, ideally, the detailed program should be clear, understandable and, so to speak, independent of the organizational framework.

This validation step has two real benefits: First, it acquaints the designer with the specific requirements of the project in a way that is thorough and detailed; second, it provides an external source of programmatic review. This latter point is important. I, personally, have a high regard for the design firms working on our projects and particularly value their review of a detailed program. Many of their suggestions have been invaluable and have clearly contributed to an improved facility.

In summary, this three-step approach to building design programming seems to work well for us. Viewed broadly, our academic areas—the front line of higher education—seem to be getting the kinds of facilities they urgently need and the State of Michigan, the Federal Government and private donors would seem to be getting sound value for their dollar investment.

There are, however, difficulties. Building design programming seems clearly in the infancy of its development and, therefore, would seem to be altogether too much of an art and far too little of a methodological science. In short, a good program seems more closely related to the art and ability of the programmer than it is to a readily transferrable and easily understood methodology which can be readily taught and applied. Because of this factor, it is exceedingly difficult to secure personnel who are appropriately trained. Rather, we are forced to rely, for all practical purposes, on the development and training of programmers on an essentially apprenticeship basis. Obviously, this is time consuming, frustrating, and costly.

Admitting that many difficulties remain in the area of building design programming, that there are many frustrations, and the procedure itself is often expensive, it seems quite clear at this time that the operation in terms of results is well worth the effort. After all, when one looks at the gigantic investments currently being made in physical facilities, one can only conclude that any procedure which materially assists in insuring that the facilities themselves will prove useful to the users over both the short and the long term is, in fact, not only a wise investment but may very well prove to be the most valid expenditure of all. ☐

The Sociological Implications of Programming Practices

by
Robert Gutman

I am not sufficiently familiar with the architectural tradition to have a rounded view how the architect's program is conceived by architects themselves. However, my experiences in working with architects in schools and in practice makes me think of it as a sociological document.

Why do I regard the program as a sociological document? In the first place, the program is inevitably a description of a particular set of relationships which the architect, the client, or both parties believe should be preserved or created in the environment of a new building. For example, the program for a science building in a college will list, say, the number of laboratory spaces to be provided for chemistry, biology, and physics, how many for instruction or for research, what the circulation spaces are to be among them, whether priority is to be given to space for faculty research or for instruction, the links between this building and buildings devoted to other fields of study which make up the college curriculum, and so on.

In some cases, the written program will simply list the required spaces and services; other programs, usually considered to be more adequate, will actually discuss the assumptions which went into the decision to provide a particular list of requirements. Whatever the quality of the program, however, it can be read as a series of claims, sometimes explicit but more often hidden, about how the clients and users of the future building ought to behave and function in it. The program inevitably tells us something about the values, the norms, and the organization of the college community.

What I am saying is fairly obvious. If the programmatic dimension of buildings were not so clearly indicative of the intentions and values of the culture in which they arise, archeology and architectural historiography could not operate as disciplines. Yet despite this fact about the nature of building, professional architects do not, it seems to me, make enough of it in their programming efforts. Or to put it in another way, the profession should put out more effort to convince the client and user that every building project demands a close scrutiny of the values, goals, purposes and present mode of social organization according to which clients and users conduct their own affairs. Are the goals appropriate for the organization? Does the structure of the institution represent a rational means for achieving its goals? Questions of this kind should be raised during the programming phase.

Secondly, I regard the program as a sociological document because every program necessarily proceeds in terms of certain assumptions about the way in which the spatial environment and behavior are tied together. In most cases, spaces are assigned particular dimensions, or are linked in a specific way, deliberately, because the architect assumes that a particular quality of space, or a particular location will produce a certain behavioral result. Architects are inveterate believers that space is a major determinant of social organization, values, and behavior. Often, it seems to me, they are correct in attributing a major influence to the spatial environment. Frequently, their theories and ideas in this area evidence a much more subtle and complex sense of the nature of man than one finds among many sociologists. However, in other cases I have found architects making claims which represent gross errors or are vast oversimplifications.

Research Technology

There is a third sense in which we can speak of the program as a sociological document, and it is the sense, I believe, in which the use of sociology in programming is now most widely recognized in architectural practice. The accumulation of the data which are required for the program often can, or does, make use of research techniques developed by sociologists. The techniques include depth interviews, activity records and diaries, and questionnaires, including mail questionnaires. These techniques are proving especially useful in dealing with what architects call the non-scheduled use of space—all those activity patterns taking place in the built environment which do not show up in the administrative statistics collected by the college registrar, the hospital administrator, or the housing authority manager.

In my own programming work I have been impressed by the usefulness of projective techniques and indirect methods of interviewing for revealing

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a good deal about the use of space, underlying values which dictate attitudes toward space, and the expectations of different groups within the user population about new building designs. In one project, I have been making use of slides and other graphic materials which present the respondent with a map or image of the present built environment available to him. I ask the respondent to describe for me the way in which he moves through this space during the course of a typical day, why he chooses the path he does, why he uses particular buildings and rooms for specific purposes, and what changes he would like to see made in the present environment. I have found that the use of graphic material accomplishes several purposes simultaneously: it circumscribes and focusses the topics discussed in the interview; it helps the respondent without architectural experience or who may have a poor visual memory to talk about space utilization productively; and it educates the prospective user or client to the complexities of the design process.

A Sociological Document

I have said that I regard the program as a sociological document because it describes a cultural and social system, because it is a theoretical exercise dealing with the determinants of behavior, and because programs make use of social research techniques. But there is a fourth reason why I look upon programs as sociological documents—they are products which are the end result of institutional innovation. Like all other social inventions they threaten the social systems out of which they arise. Yet all too often, architects and the others who draw up programs seem insensitive to their disturbing effect. As a result, the profession has failed so far to come to grips sufficiently with the strains induced in the architectural office and in the organization of the client by the programming process.

Under present conditions of architectural practice programs grow out of the work of groups. The groups are made up of representatives of the architect, the client and the prospective user. The constituencies represented have different ambitions and interests. The architect probably wants the program to be developed completely and quickly in a final form so that he can proceed to the task of design. The client shares this ambition, but often he is willing to sacrifice economy for everything else. The user often is different from the client and, in such a situation, tends to be concerned with commodiousness and a workable environment rather than the cost of the project.

The difficulty of formulating the program is compounded because the client usually does not understand the complexities of the architectural task, and all too often seems to take the view that the architect's fee is excessive. The architect, in turn, is not sensitive to the constraints under which the client and his organization operate and becomes impatient with the apparent inability of the client to formulate his program requirements in final form. The difficulties faced by the programming group are exacerbated because the various parties frequently cannot communicate with each other. Clients are typically so rooted in their own situation that they cannot take the objective stance with regard to needs which the architect ideally desires. The architects are trained to communicate in graphic and visual media, which many of the users and clients cannot understand.

These difficulties are less troublesome in very large offices. A good deal of intraprofessional specialization develops here and there in separate staff skilled in dealing with the technical and human relations aspects of the programming process. It also is easier for all parties when the client is experienced in dealing with architects and so knows what goes into the architectural process and what it is reasonable to demand in the way of services from the architect. But I think that these more favorable conditions are still the exception and, for the large majority of architects, program development continues to be a hit-or-miss affair, in which each project presents a new challenge with which the architect must learn to cope without possessing an adequate backlog of experience.

Sociological contribution

It would be absurd to argue that sociology and the employment of sociologists offer ready solutions to the organizational problems of the programming process. Nevertheless, I do believe that sociology can play a part. The few sociological studies of the architectural process already published should be more widely known and read by students while they are still at school, and probably should also be read by practitioners. They cast an informative light on the problems architects face—self-knowledge is a prerequisite to dealing effectively with problems, whether on the level of the individual or the profession. My experience in dealing with both architects and their clients in program development also leads me to think that a third party who could serve as mediator between the architect and his clients would be of some use. He could interpret the intention of the architect to the client and would alert the architect to the variety of organizational and cultural constraints which often are responsible for the inability of the client to make objective determinations of his space and service requirements. Sociologists might well perform this mediating role as a by-product of what I regard as their more legitimate function—namely the use of sociological theory, sociological knowledge, and social research techniques to develop more thorough and more comprehensive program documents. ☐

The Value of Facilities Programming to the Client

by

Edward J. Agostini

Value takes a variety of forms. It can be tangible—you can express it in dollars or some other measurable standard. Or it can be intangible—you know it's there but you can't quantify it. Then again, some values are positive. They are plus factors that give you more for your money. And others are protective. They guard against possible losses, in money, time, efficiency, convenience, morale.

In discussing the value of programming, I'd like to begin with specifics on the tangible worth of a good program.

Programming Costs

Let's establish what we are talking about in terms of cost so we have something to measure value against. How much does a program cost? As a general rule of thumb, the cost of a professionally prepared program is less than half of one percent of the construction cost of a new building. This, of course, will vary with the complexity of the client's operations, but it can serve as a guideline. If we estimate new building cost at $30 per square foot, the program cost is less than 15c a foot.

What we are saying is that, for 15c a square foot, the client, the developer and the architect start the project with a program which insures that the new facilities will effectively support the client's operations, make the best use of its human resources, and accommodate its future growth in an orderly manner. This is quite a bargain when you consider the kind of improvement 15c a foot buys in flooring or hardware or furnishings, which have so little effect on the vitality of the client's business. Furthermore, if you capitalize the cost of the program and amortize it over the life of the building, it comes down to a few hundred dollars a month. This is a modest price to insure that a multi-million dollar building meets its occupant's needs.

Keep in mind that we are talking about a once in a lifetime capital investment that probably involves the single largest outlay by a company for many years. Here are a few examples of how good programming can create specific savings in this initial investment.

The basic clerical work station is one of the smallest standard units in an office. In its simplest form, it includes a desk and a chair with adjacent circulation space for passage and the movement of the chair. As programmers, my associates and I have developed a wide range of individual work space standards that establish optimum sizes and distances required to function effectively. For the purpose of argument, let's say that the optimum size of this basic work station is 6 x 8½ feet. The uninitiated might vary the six foot dimension by six inches in either direction. If it is six inches smaller, there simply will not be enough room; it won't work. If, on the other hand, it is made six inches larger than is necessary, we increase the size of this station by 4¼ square feet. In an organization of 500 employees, if there are 300 such work stations, we are talking about an increase in the size of the building of 1,275 square feet. Calculated at $30 per foot construction cost, this involves an unnecessary increase in initial investment of more than $38,000. This comes to something like a 1½ percent increase in the total cost of the project just for an extra six inches that isn't needed.

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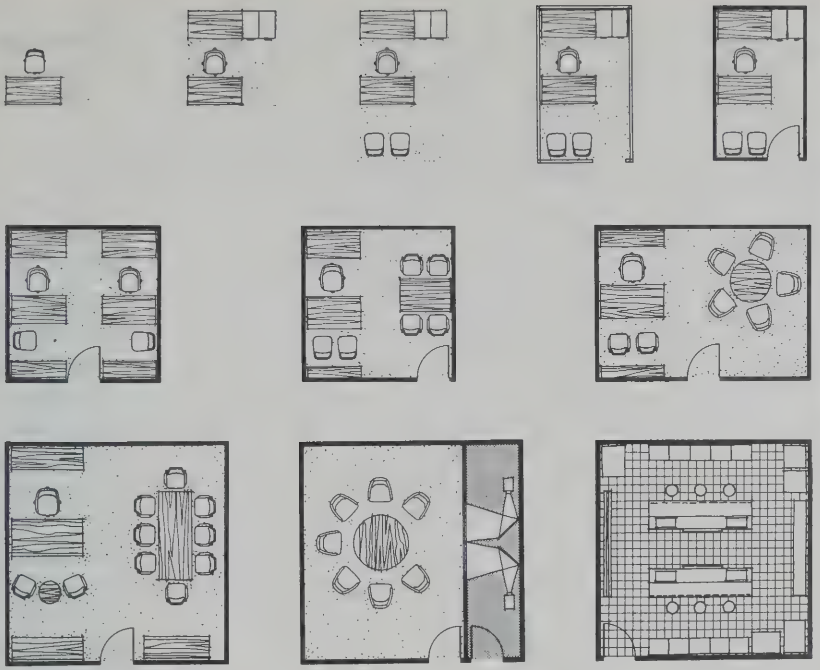
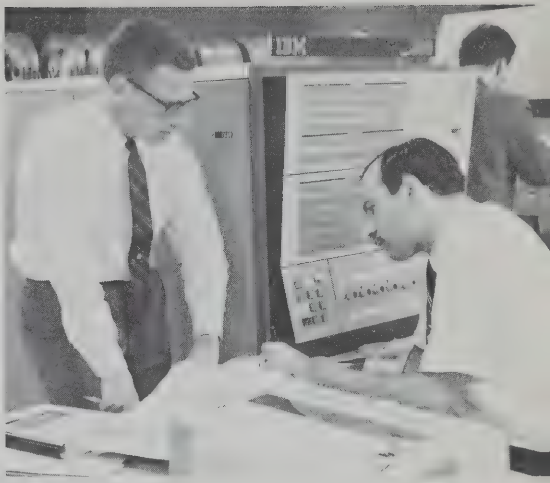


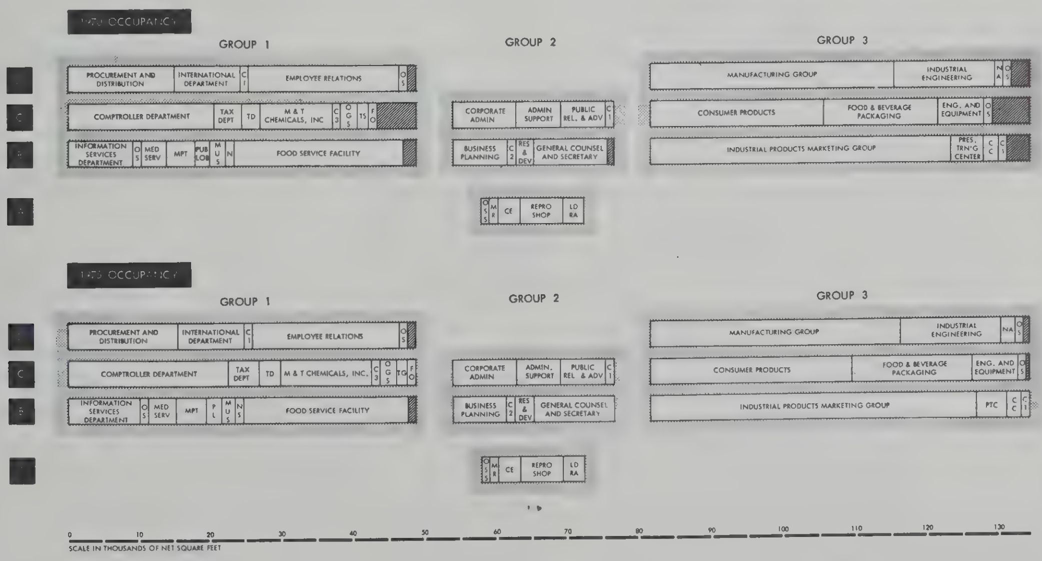


Above, Becker and Becker staff at work developing computer assisted space planning program; Left, Individual space needs are analyzed for repetitive activities.

Here are some of the fundamentals for developing space standards. Getting back to the basic clerical standard, let's consider other functions—the need for more equipment, seating, supervision of subordinates, privacy and security—as well as the potential for sharing space and in-office meeting requirements. In addition, individual studies are necessary to determine the space needs for special activities like management communications, laboratories, or electronic data processing.

By applying these standards, like-functions receive like-space, and maximum utilization is gained. Establishing the relationship of these standards to a range of modules can be helpful to the project architect. This is shown by the module chart.

These carefully developed space standards are the basic building blocks which become functional groupings of the entire organization. These groupings satisfy adjacency needs, traffic, and work flow, and future expansion requirements, as illustrated.



	REPORT STANDARD	POSSIBLE BUILDING MODULE						
		3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"
1970	315,064	317,790	318,293	318,162	316,722	319,590	325,697	319,472
1975	331,521	334,415	335,099	334,965	333,293	336,439	343,109	336,313
1980	345,612	348,639	349,582	349,466	347,572	350,934	358,176	350,829

ABBREVIATIONS

C1	SHARED 12 PERSON CONF ROOM	MUS	MUSEUM
C2	SHARED 20 PERSON CONF ROOM	NA	NATIONAL ACCOUNTS
C3	SHARED 30 PERSON CONF ROOM	NS	NOTIONS SHOP
CC	CONFERENCE CENTER	OS	OFFICE SERVICE SATELLITE
CE	CENTREX EQUIPMENT	OSS	OFFICE SUPPLY STORAGE
FO	FACILITIES OFFICE	PL	PUBLIC LOBBY
LDRA	LOADING DOCK & RECEIVING AREA	PTC	PRESENTATION & TRAINING CENTER
MPT	MGMT PROF & TECH PERS ADMIN	TD	TREASURY DEPARTMENT

▨ EXPANSION SPACE

FUNCTIONAL GROUPINGS SOLUTION A

BECKER AND BECKER ASSOCIATES, NEW YORK AND LONDON

Particularly interesting is the subject of movable partitioning and underfloor ducts for wiring. They have come into widespread use because of their value in adding flexibility to space. And properly used, they are of value. However, they can also create a false sense of security. Movable partitions only provide flexibility when you have the space to move them around in and a plan for rearranging them.

These building components cost about twice as much as conventional partitions and floors, although flexible partitions, in fact, have poorer acoustical properties than dry wall partitions. By properly programming space use, it is always possible to establish certain areas which will be stable over long periods, so that the across-the-board use of flexible material is neither necessary nor desirable. In a specific case for one of our clients, partitioning and floor construction costs were reduced by $250,000, simply by recognizing that the installation could be permanent in designated areas of their offices.

There are many other examples of measurable savings just involving initial investment. As you can see, the cost involved in any one can more than repay the cost of a good program.

Operating Efficiency

And we should also consider the contributions of effective programming to operating efficiency. "The development of abilities is at least in part a dialogue between the individual and his environment," according to John Gardner, former Secretary of Health, Education and Welfare. Even the greatest doubter will concede that environment has some effect on functioning. While granting that precise measurement is difficult, we can do worthwhile analysis. Let's say, for the purpose of argument, that there is a 5% improvement in efficiency if work stations are properly designed and work and traffic flow patterns are optimum. This means work that could be performed in an hour under the best conditions will take 63 minutes in poorly programmed space. That doesn't seem unreasonable. Nevertheless, the work of an organization must be done by people within the fixed time limits of the working day. A staff of 500 must be expanded by 25 employees simply to compensate for a 5% differential in efficiency. The cost of this is staggering. In salary alone, at $6,000 a year average, it comes to $150,000 annually. If you figure the extra space needs at an average of 100 square feet per employee and $40 a foot for construction, furnishings and equipment, it involves an initial investment of $100,000. All for three minutes an hour worth of built-in inefficiency.

To go further, consider what we call the "Theory of Compounded Inefficiency." If you start with 500 employees operating at a 5% loss of efficiency, you have to add 25 employees to get the work done. Now, adding 25 employees produces crowded conditions which then reduce the efficiency of the larger number of employees. Where will it all end?

Looking quickly at the subject of adjacencies—and by that is meant the relative locations of company units and personnel within them—studies have been made of wasted walking time in business organizations and dollar values for this time have been developed. I ask you for a moment to consider not only this loss, which is readily understandable, but also the loss to a company from the walks that are never taken because the executive involved doesn't want to expend the energy required for the trip.

No discussion of the economic value of programming is complete without considering it simply as insurance against disaster. If our experience has shown anything, it is that poorly programmed space can be disastrously expensive.

We have been doing an analysis for a large company which moved into new quarters three years ago. Within the first two years it spent a million dollars rearranging and expanding its new facilities. Last year it was forced to move several hundred employees out of the new quarters into additional leased space. We were called in to develop a new program to straighten things out. It will cost $250,000 in reconstruction.

In cases such as this there is a three-way loss. In the first instance, there is the damage to operations from the problem itself, before it is rectified. Then there is the drain on management's time and energy developing a new solution. And, finally, there is the dollar cost of implementing the solution.

Management Pitfalls in Facilities Planning

What can management do to avoid pitfalls in facilities planning? When a client needs new facilities it means he has a problem. The client management must first recognize that there is a problem. This is not a trivial matter. In a time when rapid business growth is both prevalent and revered, there is a common misconception that inconvenience is a necessary and unavoidable consequence of growth. The client must understand that there is such a thing as planning effectively for orderly growth.

After the problem is acknowledged, management must avoid the false optimism of easy solutions. There is a tendency to believe that, if facilities are new, larger and designed to be flexible, somehow everything will work out. In the same way, new space is seen to be inherently more efficient than old space, so that the simple act of moving is frequently accepted as the solution to the facilities problem. Even if management goes one step further and decides that it should provide room for expansion it must have an explicit plan for growth. Future needs must be defined and related to specific physical requirements.

Another potential hazard is the self-study—the use of an internal audit, by company personnel, of space needs and growth projections. Management must be aware of the dangers of self-study. Primarily, the development of a program requires knowledge, experience and objectivity. It is a rare company that creates new headquarters facilities more than once in a generation. Even the most intelligent and conscientious executive, if he is given the job of developing space use requirements, simply does not have the training and experience to handle it properly. Interestingly, experience shows that management invariably underestimates its requirements. A sound program, specifically providing for present and future needs, most frequently results in *larger* facilities which, in the long run, turn out to be more economical for the user.

In any event, top management must take a direct hand in shaping the facilities or the facilities will shape the organization. There is a best solution and management must find it. In the words of Peter Drucker, considered by many to be the leading business management authority, "Both undersupply of facilities and their over-supply are extremely dangerous. Physical facilities cannot be improvised; they must be planned."

The proper planning process offers more than the avoidance of problems. It provides a positive opportunity and one that may occur only once in a management's lifetime. Certainly management should approach programming new space with the same precision and seriousness of purpose that it brings to a new production facility.

The development of a program can prompt a therapeutic reexamination of all company procedures and organizational relationships. Such an objective evaluation creates a unique chance to make a clean break from the familiar, but not necessarily effective, ways of the past. In addition, the creation of new facilities gives management a special opportunity to do something tangible for its people. It is a chance to communicate management's attitude towards its personnel in visible physical terms and, in fact, will be viewed in just this way by the employees. By the same token, a well functioning office environment is a valuable influence in keeping and attracting good people in a highly competitive and costly employment market.

When programming is properly handled, it also gains maximum participation by key executive and supervisory personnel in the organization. This sense of participation is a great positive force for company morale. Participation also leads to endorsement and acceptance of new facilities by the entire organization. A properly developed space program results in continuous management control and full utilization of human and financial resources.

These are some of the ways in which a professionally-developed program helps the client. Logically, he should be the principal beneficiary because he pays the bill, not only for the building, but, under the best arrangement, for the program as well.

There is an important value to the developer and the architect in starting a project with a signed, authoritative document stating the client's needs completely. There can be no question about responsibility for omissions which can wreck schedules and budgets if they are discovered later in the project.

Value to the Architect

The architect, particularly, has a great stake in the soundness of the program. Even though the standard agreement gives the responsibility for the program to the client, the architect cannot depend on this. A recent AIA study showed that the client provided the program in only half the cases studied and that only 60 percent of the programs were acceptable. This means that the client provided a usable program in only 30 percent of the cases.

There are a few other ways in which the architect benefits economically and operationally from a good program. First, an objective program provides the architect with criteria he needs to evaluate his design solution and can serve as a tool for internal management control in his own organization.

It maximizes the time available for meaningful design, by avoiding wasted time on irrelevant solutions. This is crucial because design time is high cost time, involving the best talent of the firm. It is also the stage of the project that presents the greatest problems of time and cost control. The whole profit from a job can be dissipated if preliminary design time gets out of control.

A good program also gives the architect a realistic basis for evaluating his needs for outside technical consultants—before he sets his fee. This is vital to profitability too.

Overall, there is a direct correlation between program quality and profitability for the architect. I refer to the same AIA study which analyzed 1,022 projects in which the client provided the program. Pre-tax profit averaged 11.8% when the architect rated the program "good." For those where the program was rated "poor," profit dropped to 7.9%. That is a 33% reduction in profit.

Design Latitude

That a good program provides wide design latitude is well illustrated by the role of programming in the design of the new Boston City Hall, which is being acclaimed as one of the great public buildings of our time. In 1959 the New York office of

City Hall, Government Center, Boston, Massachusetts.

Becker and Becker Associates, as part of our overall programming assignment for the Government Center in Boston, developed space requirements data which were made part of the architectural competition documents for the new City Hall.

The competition was conducted by the AIA and the entries were judged by a jury. The winning entry was extraordinary, but met with some community resistance. At this point, the Government Center Commission turned to its programming consultants to confirm that the space allocations met the functional requirements set forth in the program. Becker and Becker's testimony to the functional validity of the building, coupled with the prestige of the AIA jury, make it possible for this outstanding structure to proceed exactly as the architect had conceived it. The design was based entirely on a written program. The architects, in fact, had no direct personal contact or dialogue with the client prior to design. The design grew from the program and was supported by it.

One more point, bearing on the use of a programming consultant by architects, is made by George E. Kassabaum, President of the AIA. "Regardless of the size of the firm, an architect in 1968 does not always have the personnel, the time or the temperament to do all of the things that must be done to give a full service to his clients. He must supplement his own talents and abilities with the knowledge and experience of others. It is this concept of a 'team' effort that holds out hope for the architectural profession's retaining influential force in developing tomorrow's physical environment."

I have given you some examples of the tangible and intangible values, plus values and protective values of good programming. I want to emphasize the word "good." Every new facility has a program, like it or not, just as it has building plans, good or bad. There will always be some idea of what the facilities are supposed to do. But management must recognize that its facilities are more than just shelter and that they are a living, organic part of operations.

A good program helps to produce a better building, a more satisfied client, and a more profitable commission for the architect. The independent programming specialist can help both the client and architect in achieving a good program. ☐

Programming and a Computer-Based Cost Analysis System

by

Arthur R. Cogswell, AIA

The cost-analysis system with which this paper is concerned is called IBIS, for Integrated Building Industry System. It was developed because of the need for an improved cost estimating tool for the building industry and for designers operating in that industry, most particularly in the low-income housing segment of that industry. Principle funding was from The North Carolina Fund, our sponsor, and from the U.S. Department of Housing and Urban Development. Our own practice as architects had made us only too painfully aware of the inadequacy of available estimating tools. Generally speaking, the techniques that are published and available commercially are not precise nor responsive to variations in local conditions and are not sophisticated enough or versatile enough to be used during design as an effective tool.

It is commonly thought by the layman that it has always been possible for the architect to make realistic design decisions, based on the stated program and the stipulated budget, but this is not always the case. Rather, his decisions are made on the basis of his own necessarily limited experience together with data that may or may not be recent and accurate, in supplement of which he can only employ intuition, whimsey, and a certain measure of hope. In witness to the lack of effectiveness of these tools we have only to note the numbers of buildings around us which exceeded the designer's budgets and failed to fulfill their purposes as expected.

Making the problem more difficult is the fact that industry has presented the architect in recent decades with such an overwhelming variety of new materials and products that it is beyond his capacity to keep in mind enough information concerning performance and costs to enable him to select for the design of a building that one combination of form, structure, plan, materials, mechanical equipment, and site arrangement that represents the most satisfactory design for the available budget. It is simply beyond human capability to explore the complex interactions relative to cost between all of the components which may be considered during the development of a design.

In the fall of 1965 it was proposed to The North Carolina Fund that it sponsor an effort to develop a computer-based cost estimating tool which could be used effectively by the architect in developing improved designs for low-income housing at a minimum cost. The Fund agreed to sponsor the project, additional funding was obtained from the Department of Housing and Urban Development and work was begun in December of 1965.

System Capabilities

It is not too difficult to suggest what sorts of capabilities a system of the sort discussed here should have. It should, first of all, be capable of handling a substantial library of cost information, which would preferably be taken from local sources and be frequently up-dated. It should be able to accept information and produce reports with a minimum of effort on the part of the designer, with a minimum of delay, and above all it

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should not be necessary for an architect using it to develop entirely new ways of thinking about architectual problems. In other words, the new tool should merely replace, insofar as possible, the pencil and sketch paper in the architect's hand, yet permit him to use the same thought processes to which he has become accustomed in solving problems.

This is perhaps a bit more glib than it should be, because of course we knew that in providing the architect reliable cost information, to which he had not had access before, we would inevitably be changing the manner in which he approached his problems, and the area most liable to change was the relationship between programming and design in the context of cost analysis. But it was obvious that, from a practical standpoint, unless the new tool was capable of being adopted by practicing professionals without the renunciation by them and by the building industry of basic procedures and techniques, it would never be used in the field.

IBIS is capable at this point of accepting a three-dimensional description of a building and its interior arrangement, using a simple polor coordinate system, and is able from this description, together with outline specification data which the designer supplies, to produce a quantity survey of the materials and labor required to construct the design which the architect has just described. It is then able to pass this quantity survey through the cost library previously stored and produce a cost estimate for the design under consideration.

System Processes

In order to use the system for low-income housing the designer would proceed as follows. He would first approach the machine with a rough sketch of the design he is developing. He then enters descriptive data concerning his project on several forms which are then converted to punch cards. This amounts to a shorthand description of the building in its essentials. This particular part of the process can be as well accomplished by a secretary before the architect begins his cost analysis.

When the designer has entered the required information concerning the building, a series of reports is produced; these can be conventional printouts, perhaps on a remote console, or they may be displayed on a scope. The reports which the designer receives at this stage include a quantity survey of materials and labor, a list of the construction equipment that will be required, a list of all the construction detail situations which will require explanatory drawings, a list of all the construction operations which will be required together with a list of the associated trades, and if he elects, he can receive a print-out of the specifications for the project as it then stands.

If he concludes that his design is something less than perfect, he can change it and see the resulting change to the cost. The modifications that he makes in his design will be made in the way that he has traditionally refined a design within the limits of its program. He may manipulate its form, its plan and size, its structure, materials, orientation and location on its site, or any of a great number of other factors which determine the configuration of a building. In this he is acting as he always has, the difference in this case being that he is seated at a computer keyboard rather than at a drawing table and makes his design modifications by typing them in.

Working in this fashion, then, the architect proceeds as he traditionally has, developing a solution according to the dictates of his intuition, but with the aid of data which he requires, but has never had, in order to make a rational decision. The important thing here, of course, is than he can readily explore a much wider array of design possibilities than he has been able to in the past, and can meaningfully compare the advantages of one approach to another, or to many others. He can explore without too much labor the interplay between various structural systems, materials, site arrangements, and plan configurations with an ease which has not before been possible for him.

Working Procedure

Before going further I should stress that what I have described here is possible at this point, just barely possible, for a very simple building type: the low rise low-income dwelling unit. The system is working now in a rather cumbersome and inelegant fashion, rather blantantly awaiting further development. No claims are made or intended here that the system I have described is ready for large scale application in the field. As it stands now it is much more cumbersome and inconvenient to use than we should like and is, at the same time, less precise and less responsive than we intend to make it.

But it is a step forward and does permit the designer a degree of confidence in his design that has not been possible before. He can at least satisfy himself that his solution approaches being the most economical and suitable one for the situation at hand. The use of this system has nothing to do with the aesthetic quality of the result. A bad architect using this system will produce bad work. It is our feeling that an architect of some perception and talent will produce better work with the aid of this tool than he could without it.

Obviously the work described here is merely the first step in the development of a comprehensive information handling system for the construction industry. Programs described here are adequate for dealing with a simple building type, the low income dwelling unit, but they can be regarded only as the first imperfect parts of a system that may eventually be expanded to include other building types and to provide, quickly and economically, information required by the architect in making design decisions, by the owner in making decisions affecting his current and projected investment, by government agencies acting either as evaluator, sponsor, or owner, by the builder who would use the same information for bidding, for scheduling, for ordering materials and managing labor, and by all these individuals in monitoring these aspects of the construction process with which they are most concerned.

Programming Application

It is probable that the primary importance of a tool such as the one described here will be in the dissolving of the barriers between the steps in the architectual process. These steps—program development, schematic design, design development, and the production of construction drawings—have always been viewed as discrete steps, each to be completed and approved before proceeding to the next step. It is not difficult to see, however, that if many of the problems which have always complicated schematic design and design development are removed, these two steps will become much more facile. So much more facile, as to permit their accomplishment in much less time and at much less investment than they now require. It is possible, in fact, that a designer using the system under discussion here, might accomplish most of the design work on a rather extensive project, over the course of a day—work that would otherwise keep several people occupied for many weeks.

What I am really saying is that the barrier between programming and design may well dissolve. Currently, the business of developing a program for the design of a building is frequently performed as if there were no budget considerations. It is very difficult, in point of fact, to apply the cost/benefit attitude to a building program except in the grossest terms. It is almost impossible to evaluate program items meaningfully in terms of budget unless they are exceptional items of obviously exceptional cost. What happens typically, is that everything goes in and the program grows. Then when the program is complete, design begins. And then, when design is complete and costs come in, some things have to be taken out.

This is simply an inefficient way to go about design. If it were known in the beginning what were the trade offs between various items in a program, the design would be a much more efficient one and would better reflect the relationships that should occur between the various program elements. Effective repair of the damage made by program cuts occuring after a design is completed is often exceedingly difficult and frequently the project suffers as a result.

More important, however, is the fact that if the design process is a convenient and inexpensive one, building design can begin very early in the development of the program and can grow and change as the program is developed. Programming and design should proceed hand in hand, not as sequential processes. The sort of design tool described here might be an aid in this direction.

It would be of great use if the system could be employed for a very rapid preliminary analysis of a project. Site selection would be facilitated, for example, if a design could be developed, in its essentials, for each of several sites under consideration, to determine which would yield the most desirable balance between total project cost and benefit. It should be possible, as well, to evaluate the efforts of minimizing initial project cost as against total cost for the life of the project, including long-term maintenance costs.

Performance criteria

Another consideration of perhaps equal importance is the fact that it should be possible to supply program material in the form of performance criteria, which the machine would evaluate before presenting alternative solutions for editing and modifications by the designer. This notion has a way of frightening architects, because it sounds like a decision-making capability on the part of the machine. Important here is the fact that the machine is simply narrowing the range of possibilities—the designer must still make the decisions.

If, for example, the requirements for the various spaces in a building were expressed in a program in terms of their required sizes, accoustical properties, temperature, humidity and other environmental considerations, together with any other performance requirements that were then known, it would not be a difficult matter for the machine to suggest material choices and then to check the plan in three dimensions once the decisions have been made, to search for conflicts and anomalies.

If program requirements were presented in this general, rather than specific, fashion it would be practical for the designer to present a qualitative range of alternatives, with costs for each alternative. Faced with clear alternatives, and the ability to explore in increasing detail the costs of an increasingly well-defined design, an architect would be free to function in the exercise of an informed judgment. The famous French architect, Le Corbusier said it better: "Architects are organizers, not drawing board artists."

What has been described here is a tool that would expedite that function and permit building programming to be used, not merely as a catalog of deeds, but as an active participant in a dialogue between needs and available resources which can help us achieve more efficient design of better buildings. ☐

Research for Building Programming

by

Richard Seaton

Architects regard themselves as rationalists and accordingly they have a high respect for facts. Thus, rational programming places a heavy burden on research facilities. Programming involves diagnosis—"what is the problem"—as well as prognosis, and diagnosis typically entails investigation. Programming thus *is* research, insofar as it involves assembly of diagnostic facts, evaluation of alternatives, appraisal of resource allocations, and post-construction evaluation of prescribed forms.

One can hardly arrange, without performance specifications, a workable composite of components. Research delineates performances. One can hardly apply cost-benefit analysis without knowing costs and depreciation histories; programming research assembles and classifies cost histories. Benefits of alternative special arrangements or facilities can only be estimated by follow-up research on completed designs; such research must be collated and made available in central files. A spectrum of feasible alternatives to any problem can be derived from basic or explanatory research on unforeseen benefits or detriments of architectural components or component relationships. If a building is not to house a compulsory organization research can show how user preferences vary among feasible alternatives. If one designs for the welfare of a functioning human system, then research provides evidences of transaction rates and interdependencies. Where decision matrixes are used (instead of coin flips), research produces probability estimates. Where traffic flows or aggregates are of concern, research provides demand-estimates. Where new alternative components or systems are sought, review of research provides clues.

Since architects are rationalists, presumably they will be researchers. As of today, that presumption does not hold. James J. Souder said, "The investigation of current planning techniques utilized by architects, administrators and consultants . . . demonstrate both the importance of intuition in the planning process and the absence of criteria, even the absence of recorded experience, against which proposed organizational and physical planning proposals might be evaluated." Ben H. Evans in his AIA Research Survey (1966) noted, ". . . within the last ten years there have been less than 350 architects who have been or are now involved in research to some degree. Recognizing that not all of these people are involved full time, and

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that many are not currently active in research at all, the indication is that somewhat less than 1% of the registered architects in this country are active in research—not a very impressive record."

The National Science Foundation has for some years assembled data on Research and Development expenditures by industry, by source, and by kind of research. Among all major industries categorized according to the current Standard Industrial Classification (SIC), the Lumber, Wood Products, and Furniture groups are the smallest and have been the smallest for ten years, showing no significant growth over the decade. Since there is no "building trades industry" classification in the SIC, consider the Lumber, Wood Products and Furniture (LWPF) class as proxy for the building industry. One finds that it is the most decentralized of all sixteen major industrial classes; its top twenty firms account for a lower proportion (53%) of gross sales than do the top twenty firms in any other major industry (NSF, 1967). Each major industry employs thousands of Research and Developing employees . . . except LWPF, which uniquely has only a few hundred such employees, fewer than it did less than a decade ago (NSF, 1967). LWPF also is almost at the bottom ranking of industries in terms of R&D dollars spent per R&D person, per industry employee, per sales dollar and per net sales dollar.

At the same time, Federal research dollars allocated to the Department of Housing and Urban Development (HUD) for housing and building research have remained relatively miniscule. Estimated R & D obligations for HUD (according to the National Science Foundation in 1966) in Fiscal Year (FY) 1968 were over 20 million, but actual obligations in FY 1968 amounted to half this figure. This appropriation, which is twenty times larger than that alloted to HUD in the previous year, includes no systemization of scientific and technical information retrieval, no basic research, and no development of plant for in-house research. At the same time, gigantic appropriations for military R&D for National Aeronautical and Space Administration (NASA), AEF and the Department of Health, Education and Welfare (HEW) absorb well over 90% of the $16.7 billion allocated to Federal support of research and development in 1968. Among the small per cent of dollars remaining, the Department of Transportation (DOT) had 1968 research and development obligations in the order of several hundred millions, while HUD research and development obligations scarcely equaled those for the Federal Rail Transport Administration, the Office of Economic Opportunity, the Vocational Rehabilitation Administration, or the Smithsonian Institution.

These data suggest that the building industry is not over-researched, either privately or by the Federal government. In contrast to hundreds of agricultural research stations and a dozen or more textile and clothing research stations, there are only a handful of government building research stations.

Acceptance of rational programming of buildings must inevitably provoke expansion of research and development. For example, after Mr. Hitch established the planning-programming-budgeting system in the Pentagon in 1961, the Department of Defense (DOD) total R&D budget increased from about $3 billion to about $7 billion in a few years. Similarly, the HUD R&D obligation in 1968 is almost three times its R&D obligation of $7.7 million for 1967 (NSF, 1968).

The inception of building programming demands a rigor conducive to research and research reflexively contributes to the rigor of analysis. Since by Presidential fiat in 1965 fiscal programming is normative in all departments of its Federal Government, the rapid expansion of HUD R&D over the past few years was to be expected. Certainly the amounts committed currently to research vary radically from the research dollars allowed to the pre-1965 Federal Housing and Home Finance Agency, the predecessor of HUD. Yet in terms of 1967 obligations HUD ranks very low among major Departments of Government in terms of the proportion (1%) of its obligations to be allocated to R&D.

Serious adoption of building programming puts one in the research business. Programming requires explicit goal statements: when measurable targets are stated, research can be applied. Goal statements properly can be exposed to the conventional wisdom of the design community so that superior social indicators of goal success may be delineated and standardized for the building industry. Generally, the programming of research into research programming produces a number of effects through time.

1 Research on building programming promotes rigor of thinking and sharpening of method.

For example, designing a sample for a social survey of building users leads to more precise definition of the target subpopulations for architectural design; a sloppy sampling procedure implies sloppy thinking about who's to benefit or suffer from a proposed construction. It is when a building contract proposal is facing stiff competition that the exactitudes of well-researched cost differentials come to the fore. Generally, a building program builds on research. If the research is shoddy, the program will not be much better.

Compulsory exposure of a programmer to research inputs will enhance his sophistication, so that he likely will become sceptical of percentage point differences based on small or unsystematic samples. He will become more familiar with factorial design and its benefits. He will become increasingly skeptical about projections into the future and heavily discount out-year benefits. Eventually, a new technology of research appropriate to building programming will emerge, just as it has in industries which earlier adopted rational methods. Where there's a will, there's a way. Architectural programming needs research, so research sophistication will emerge. Expectations (hypotheses) about design effects will be explicitly stated. Reliability tests will be regularly applied. Questionnaires will be pretested and sample achievements less than 75% will be viewed with distaste. Frequency tables based on small numbers (less than a hundred) will no longer be percentaged. The costs of Type I ("false positive") and Type II ("missing a good bet") errors will be made explicit. Data will be fitted to cost models; out-year extrapolations will be bounded with confidence intervals. Unobstrusive measures will be mined and correlations among such measures will lead to confidence in performance criteria.

2 **Research-based quantification of goal criteria in purposive programming opens the door to feedback on building performance relative to programmed expectations.**

With reliable feedback, poor design solutions can be recognized and often rectified through alteration, instead of enduring unchanged through the life of a building. Past mistakes can be recognized and avoided in future buildings. With feedback, learning can take place in the design professions and the skillful practitioner will gain reputation on the basis of measured user performances rather than appearances.

Feedback research differs from conventional "field" or "in situ" studies of the environment by taking specific cognizance of the designer's intentions (goals) and ascertaining whether they are achieved. However, published studies of building feedback are few: as Goethe remarked of the architect, "How often he expends his whole soul, his whole heart, and passion, to produce buildings into which he himself may never enter." Aside from the intrinsic difficulties of measuring the achievement of vaguely-expressed goals affecting different user subpopulations, one may suppose that any designer would have mixed feelings about systematic research attempts, months or years after completion of design work, to learn whether his construction "does" what it was designed to do.

On the other hand, retail and commercial branch facilities of major multiple-outlet firms are customarily exposed to recurring scouting to ascertain whether designs are achieving corporate purposes. The giant Bank of America, for example, maintains agencies solely concerned with premise research and branch bank design. Supermarket chains routinely check the impact of gondola layouts and visual displays on circulation and sales; in those endeavors they are aided by Federal government studies. Drive-in theaters are highly rationalized, perhaps because they are expensive but relatively simple. The same applies for gasoline station outlets of major oil companies.

"Customized" buildings designed by architects are less often systematically appraised in terms of goal achievement. Often the only feedback an architect gets is whether his construction is renting or selling well, because market demand for building space often is almost the only concern of those who commission buildings. However, a number of goal-achievement studies exist, including an appraisal of a windowless school, the long-term study of a sociopetal dormitory, University-sponsored researches of dormitory space utilization, Weiss and Bouterline's scouting of circulation designs at the Seattle World's Fair (1964) and recent work on publicly-supported housing. The cooperation in these studies of architects who were willing, if not always readily able, to expose their concepts of building goals to empirical test is commendable. The growing application of purposive programming in building design is likely to lead to normative *post hoc* researches of the design and performance of buildings.

3 **Sometimes surprising findings emerge from watching what people do in designed spaces.**

For example, there is good evidence that the "capacity" of an eating hall or cafeteria is radically less than the number of seats in it. Bus stop benches are "filled" when half occupied. Given opportunity, design students arrange studio space to reflect sociometric patterns. Students in small high schools gain wider social participation but achieve lower performances than those in large high schools. An increase in cafeteria illumination can reduce by 50% the average supper feeding interlude in a University dormitory. When systematically assembled in archives, incidentalia like these provide clues to how a designer may shape an environment to achieve stated purposes.

4 **Objectively successful design features will be repeated and may to a degree become standard.**

G. Myrdal remarked in his *Realizing the Promise of Industrialized Housing,* "Buildings are complex products. They have to satisfy different needs; they must be adapted to differences in outside conditions (climate, ground conditions, earthquake hazards, etc.). And tastes are different. But this does not justify *unlimited* variations of the product, and in particular of its components. Indeed, more discipline is necessary on this point. No other mass industry has developed without standardization of its products.

"Investigations into the composition of actual output of the building industry have revealed tremendous variations of the building product. And most of these variations could not at all be motivated by difference in functional requirements or preference of the consumers. On the contrary, the requirements—in particular in residential construction—have been found to vary rather little and the tastes to be conventional and traditional.

"The samples made of produced houses show a number of almost identical types of product: millions of almost identical living rooms, bedrooms, kitchens, bathrooms, etc., are produced. But the small variations in measurements and arrangements prevent effectively the adoption of industrial methods of mass production. All these differences are not—in the majority of cases—specifically asked for by the actual consumers but are prescribed by the impulses of designers, investors, or client organizations."

Elsewhere he notes that although bulk and a low value-to-weight ratio contribute to decentralization and heterogeneous standards, today more than half the production value of a building represents outlays for materials, components and equipment delivered to the building site by supplier industries. Suppliers will continue to force product and component differentiation on the building industry, until purposive program research by the industry discloses competitively more successful design features, until the need for programming simplicity enforces the specification of standard and modular components, or until building industry consolidation permits economics of scale through standardization.

5 Systematic application of research and analysis in building programming is likely to induce innovation.

When an analyst specifies goals proviously unthought, or recognizes that assume parameters are mutable, "black box" analysis of a programming problem can lead to unique designs and component characteristics.

Thus, for example, analysts in the Department of Defense discovered that a hypothetical airplane as big as an ocean-going freighter and capable of lofting a whole platoon of fifty-ton tanks over a 5,000 mile ocean could be handled by a specially large and fast plane. A large fast plane, however, would not be feasible if stateside logistics and lightering could not be minimized through the use of modular bulk containers. Men and their combat machines do not pack well. Symbiosis was achieved by relieving the Military Sea Transport Service of time-consuming troop movements (troops and tanks could be moved by air) so that specialized Fast Deployment Logistics Ships became practical for the support of huge troop-carrying aircraft.

A second constraint on feasibility of the giant aircraft was the limited availability of airfields strong enough to support its gross weight. The momentum of three hundred tons landing on a few square inches of tire rubber creates an impact which few of the world's runways could withstand. However, program analysts initially deliberately overlooked this constraint; later, when other problems were ironed out, they researched it and proposed a "unique" landing structure with sixteen giant tires to disperse the weight so that its landing pressure became tolerable on most runways. Thus "black box" analysis supported by research led to unique designs and innovative components.

6 Application of research in building programming presumably leads to more explicit consideration of theory in design.

To the credit of late psychologist Kurt Lewin is the comment that "there is nothing so practical as a good theory." Research-derived considerations of theory are likely to lead to new and different goals as well as better ways of achieving them (in design) and measuring their attainment (in feedback research). The work of Barker (1955, 1960, 1964), for example, not only advances the germinal concept of behavior setting, but also a system of measuring and classifying such places. Theories about "proxemics" derived from the studies of Edward T. Hall (1959, 1966), reportedly have led to friendlier, more sociopetal, hospital designs as well as to renewed interest in measurement of social interaction rates. Programmed research in building programming may of itself induce, too, the generation of sorely-needed theory about the behavioral and symbolic meaning of forms. Another anticipated spillover from research in building programming is the generation of profitable ideas by researchers (rather than designers), for it has been found in other industries that the preponderance of successful innovations were generated, not by management, but by exploratory formulations of professional researchers.

7 Research activities generate a great amount of data to be collected and placed in archives.

As purposive programming and its supporting research becomes more prevalent in the building industry, we can anticipate data-based handbooks detailing cost and effectiveness attributes of building components so that research and exploratory development once done need not be done again. Once research results cumulate and begin to become commonplace, a burgeoning dissemination of data and experiences can permit attainment of a knowledge base sufficient for a developed theory of the functions of designed environments. □

The Value of a Program to the Architect

by

Stephen Richardson, FAIA

In order to establish an understandable relationship between the programming process and the broad scope of architecture, we should predicate a valid definition, not found in Webster, of architecture in terms of its sociological objective. "Architecture," it has been said, "is the solution to a human need in terms of structure." Therefore, we can safely say that the success of an architectural solution thus defined is in direct relationship to the adequacy of the description of the many and often complex human needs it must properly solve.

Basic Services

Nearly all standard contracts for the architect's services now recognize the fact that his basic services include the determination, in consultation with his client, of the general requirements of the project including space needs, budget, time schedule, and so forth. These contracts usually stipulate that "Detailed investigations and analyses of the client's needs and programming the requirements of the project" are subject to additional charge as an extra service. This procedure is in recognition of the current fact of life that increasing numbers of buildings are of such complexity and are so demanding of innovative solutions that the involvement of other sciences and disciplines is essential to the process of identifying and analyzing today's complex and changing needs.

Not so long ago, most Architects would approach a design problem with the rather routine task of conducting a series of meetings with the client so as to begin formulating a "Program." From these meetings and additional correspondence, a great deal of fundamental information would be gathered, listing what the client wanted the architect to consider and where, or from whom, additional information could be found. If the client were a public body or a private corporation, in all probability the architect would be dealing with a building committee, so that the data he collected would be modified, harmonized, and further organized. If the project were more complex, a number of specialized sub-committees would be appointed representing the views of both staff and management and their various interests in finance, visual design, landscaping, and other aspects of the proposed building.

Having armed himself with this basic information—aware of the many resources available to him, the desires of the client, the recommended budget, and desired building materials—the architect would fall back on his resourcefulness and that of his staff. While some staff members filled in complex and exhaustive checklists concerned with site problems, applicable building code and zoning ordinance requirements, construction type, fire regulations and other factors, other persons would begin developing various crude activity requirements, spatial relationships, and zoning diagrams. Finally, the architect would emerge from his office with what was considered to be a "Design Program" for approval by the client and, in the final analysis, would be based essentially on studies and limitations of the budget, the owner's statement of space needs, site considerations and a perusal of the pertinent activities.

With the program having been reviewed, signed, and approved, the "Die" was cast and the most crucial and important aspects of the design process were thus dispatched. The schematic design phase was then entered into, followed by the design development phases, construction documents, and contract administration.

Needless to say, this process was often essentially intuitive. It was based on experience and, to a large extent, was a repetition of numerous previous projects of a similar nature, varying mostly in degree of expertise. If the architect was unfortunate and errored in some basic programmatical decisions, the repercussions were not usually significant functionally, aesthetically, socially, or environmentally. People, being flexible, would usually adapt in an inhibitive manner to the oversight, and generally were fundamentally unaware that a much better solution might have been available.

As I stated earlier, the challenge being put to us in our firm is of a vastly greater magnitude. More and more often design problems are very

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extensive in their ramifications and are exceedingly complex both internally and externally. Yesterday's "tools," applied to today's problems, do not suffice.

Airport Program

Today's problems might be best illustrated by considering for a moment a problem which deals with airport terminal planning and design. Several years ago our firm's services were enlisted by the Port of Seattle to design a major expansion of the facilities for the Seattle-Tacoma International Airport on the existing site. We were asked to respect the existing buildings and configuration, accommodate a projected passenger volume of 20,000,000 in the early 1980's, develop a terminal area drive system to accommodate 4,500 cars per hour, and provide parking capability for 10,000 cars. The nature of the problem was dramatically pointed out in this prognostication from a recent article in *Architectural Record* on Airport Design: "An airplane six-stories high carrying approximately 1,000 people due next year. A tenfold increase in passenger per gate. A 2-billion dollar construction need. A doubling of the nation's jet fleet."

The "Client" in this case is a multi-headed complex consisting of the Federal Aviation Administration, eleven airline companies, airport management, the Port of Seattle, car rental agencies, private car parking agencies, food facilities people, hotel people, airport employees, and of course the average airline passenger, many of whom are accompanied by well-wishers and greeters. To add to the confusion, construction staging is an extremely difficult problem in view of fact that the airport facility must continue to function 24 hours a day without interruption. Within the broader spectrum, time is of the essence, for air technology is fast out-pacing ground technology and more than adequate answers must be found. Again, to quote Architectural Record, "The planning and design of airports is, by the very fact of its vitality, demanding that architects and engineers both take a fresh look at the solutions developed during the recent past. The architect must identify, define, and organize a truly wise design accounting for the multitude of human technical and socio-economic facets of the whole problem, and guard against premature obsolescence."

The Programming Specialist

How can the architect adequately meet the demanding design problems of this magnitude and complexity? He finds it difficult enough to ask germane questions about the myriad of design factors and the astronomical number of design criteria to be dealt with. More importantly, he often has great difficulty in properly identifying the problem. Obviously, the answer is that he alone cannot satisfactorily accomplish the task. He can only cope with problems of this nature by enlisting the services of a number of consultants in various inter-related disciplines. He is, in effect, a "Generalist" or a "Catalyst," bringing together and coordinating the efforts of a number of specialists. A member of paramount importance on this team is the building program consultant.

Because the architect is not academically educated for this type of problem solving, and does not have the time, resources, or staff to effectively and expeditiously meet the challenge, we have found that the building programmer is an absolute necessity. As Gerald Davis phrases it, "The complexity of a building grows and, as we become more and more aware of the extent to which apparently random, unimportant factors can seriously affect human activity, the need for a new kind of professional service—building programming—becomes clear." "With this service to the architect and client," Mr. Davis goes on to say, "the programmer provides a significant portion of the detailed data upon which the architect can base the design of a building. The technique of systems analysis, with its careful investigation of all factors bearing on a problem and its emphasis on relating these factors to each other and to the ultimate function, is the programmer's tool."

What kind of information does the architect desire from the building programmer and how can it be most effectively presented? What kind of service should be provided to owner and architect?

From the point of view of the Richardson Associates, we have considered building programming to be a process by which the programmer distinguishes and identifies what the particular client needs (which may not necessarily be what he wants), in terms of his project's unique activities, spatial demands, zonal relationships, and environmental ramifications. This information is then organized in a meaningful manner so as to clarify the issues for decision by both client and architect.

Perhaps the building programmer's most beneficial attribute, with respect to the architect, is that he is knowledgeable in those processes which require the research and survey techniques customarily employed in the behavioral sciences—market analysis and consumer research. By systematic use of in-depth interviews, questionnaires, sampling methods, computer aids, and observation and measurement techniques, the programmer has been able to provide our firm with the rigorous information on how the many systems comprising the airport terminal complex will be used.

Translating Needs

Another of the major requisites of a good building programmer is that he serve as a "link" between the client and architect. I don't mean to imply that the programmer should transcend, in any way, the traditional architect-client relationship, but rather in such a position the programmer may serve most effectively in translating needs of the client to the architect. Needless to say, in such a capacity, it is most important that the programmer understand both the motives and the personal characteristics of the client and the architect so as not to alienate one from the other.

Obviously, these techniques and abilities, must be translated to both owner and architect in a form that is meaningful, understandable, and substantive. The form might be both written and diagrammatic, fully explaining the client's organizational structure, those characteristics which are unique to the client's problem and providing a summary of spatial requirements and zones of activity, and accompanied by various charts, tables and flow diagrams designed to aid the architect is making the necessary decisions. When warranted, this information may be reinforced by a description of a particular methodology unique to the problem which the programmer has employed. A brief inquiry into the sociological aspects of a particular study can often be of value to the architect if the building programmer believes that it deals with a fundamental issue.

Because the building programmer occupies a "middle ground," so to speak, between the architect and the client, it is imperative that his responsibilities be explicitly defined lest he stray too far into what the architect considers to be more appropriately his domain. In this respect, it is important to recognize that the programmer is not the architect but rather a consultant. The occasion may often arise that the designer of a particular building believes the programmer is improperly making what he considers to be design decisions by being too explicit in the information which he is providing. To a designer, performance-type information that is included in a report is more important, in many instances, than a recommendation of specific means for accomplishment.

For example, the factors which give rise to and indicate the advisability of a system of modular development and size in a design concept would be preferred over an actual recommended module size of four feet square with twenty foot bays. In many cases qualitative information is just as valuble as quantitative information or, in other words, "what and whys" in conjunction with the "how much and how manys."

Conclusion

In conclusion, we at the Richardson Associates are of the opinion that the future demands for effective building programming are obvious, and that the programmer, as an essential member of our inter-disciplinary process, is firmly established. For the client, we find that he offers a necessary expertise in solving problems and defining needs well beyond merely identifying their presence. For the architect, he is able to provide a better and more valid service in problem definition than can we ourselves. To the public in general, the programmer represents a professional approach which is relatively unbiased and objective. ☐

HOUSING THE DEVELOPING NATIONS

It is becoming increasingly obvious that the developing nations are fast becoming the new frontiers of the world. These underdeveloped nations, as they were once called, are developing rapidly and are providing great opportunity for new physical, social and spiritual dimensions. With this rapid development goes the necessity and the opportunity for vast new housing programs to shelter the exploding populations. This provides a great potential for American business and industry to expand their efforts and to help make such housing a reality.

"A greater involvement by U.S. private enterprise, working with local counterparts in the developing nations, can provide an effective response to civilization's most pressing challenge today. This challenge is the complexus of problems involving the world's developing nations. Unless viable and enduring solutions can be developed to meet this challenge, most of the accomplishments of Western civilization during the twentieth century will go down the drain."

In June of 1968, the Building Research Institute conducted a special conference in Washington, D. C. to bring attention to the non-technical aspects of housing for the developing nations and to identify the many organizations and agencies which can and do provide assistance. The conference was to delineate these agency programs, the aid available, and to review the financing, insurance, and legal aspects of providing such aid to the developing nations.

The conference was organized, developed and moderated by BRI member Murray Silberman, Vice President, Intercontinental Corporation, Washington, D. C. The following papers were presented at that conference. □

San Salvador apartment project.

A Two-Way Street for U.S. Business

by

Murray Silberman

During the first part of the nineteenth century the Yankee Clipper was the fastest sailing ship on the seven seas. The clippers dominated world commerce, from the far corners of the globe bringing tea and opium from China, wool and gold from Australia, as well as carrying people and supplies around the Horn to California in the days of the gold rush. These graceful American vessels were a native product developed on Chesapeake Bay at Baltimore, Maryland. The enterprising Yankee trader was known throughout the world. The courage of these intrepid sailors not only contributed immeasurably to our own economic well-being, but also spread the zeal of this young democracy and the dynamism of its private enterprise.

After the peak of the Industrial Revolution the United States established itself as the outstanding exemplification of modern industrialism and salesmanship. Tales were told about encounters deep in the jungles of Africa where, in almost inaccessible places, tribeswomen were seen pumping away on the treadle of a Singer sewing machine. Products bearing the stamp, "Made in the U.S.A.," soon became known and cherished in every nook and cranny of the world. The U.S.A. became the global synonym for aggressiveness, trade, opportunity, and development, and the private American entrepreneur dealing overseas formed a significant segment of our overall economic growth and expansion.

The U.S. continued to dominate world commerce, and our exports formed the largest importation component of most of the countries of the world. This situation developed and existed during a period of history when the proposition of doing business on an international level was fraught with much greater hazards than those we know today. Revolutions took place with greater frequency; international law was primitive, as were the peoples of the underdeveloped nations of that day; language and cultural barriers were more pronounced and the foreign businessman's lack of sophistication drove many an American to drink. Despite those obstacles, American commerce thrived, perhaps because of our Puritan tenacity and the pioneer drive in expanding our growing economy.

Although our dollar volume of exports increases annually, it is a sad fact of life that the U.S. share of the world market is declining, while that of our principal competitors has been rising. U.S. exports over the past decade have averaged about 4% of the Gross National Product; by comparison, Italy's exports rose from 10.8% to 13.1% of GNP between 1960 and 1966, while Germany's rose from 15.4% to 16.9% and Japan's from 9.6% to 10.1%

It would certainly seem logical that a realistic U.S. export expansion drive offers one of the most constructive solutions to this country's balance of payments problem, and deserves far more attention than some of the impractical and unrealistic proposals that have recently been suggested. Raising our export figure only three tenths of one percent, from 4.0% to 4.3%, would immediately add $2.5 billion a year to the plus side of the U.S. balance of payments ledger. However, this will occur only if, and when, the giant of American private enterprise, grown fat through the post-war years of phenomenal economic growth and prosperity, awakens itself to a rebirth of the same spirit and drive that possessed Yankee tradesman of earlier days.

A greater involvement by U.S. private enterprise, working with local counterparts in the developing nations, can provide an effective response to civilization's most pressing challenge today. This challenge is the complexus of problems involving the world's developing nations. Unless viable and enduring solutions can be developed to meet this challenge, most of the accomplishments of Western civilization during the twentieth century will

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go down the drain.

Within a decade or two, the population explosion will create a myriad of interrelated problems, moving us from our present crisis to a state of complete chaos. Qualified experts predict that 30 years from today some 4 billion people—or 50% of the existing population—will wage a losing battle against the basic elements of human existence: food and shelter. Should this come about, they will surely not accept such an intolerably hopeless state of affairs with resignation.

The housing crisis is part of the economic, social, and political crisis sweeping across the developing nations of the world today. The prevalence of miserably inadequate housing is universal among developing countries, and the improvement of housing is an integral part of the complex processes of development. This relationship transcends purely economic considerations, for housing relates to social and political, as well as economic, evolution.

In the "conventional wisdom" and nomenclature of economics, housing investment is defined as social rather than economic development, since it is argued that it deals primarily with individual and social welfare, rather than in directly expanding productive capacity, productivity, and production. But to those of us who see the development of a people as a unitary evolution of many interrelated processes, improvement of housing, as an element of the condition under which people live, is both an instrument and a consequence in the spiral of development. The need for better housing is universal. It extends from the ghettoes of Washington to the "ranchos" of Caracas, the "favelas" of Rio de Janeiro, the "callampas" of Chile, the "casas brujas" of Panamá, and the reeking slums of Calcutta. The active desire for better housing is in itself an expression of social and political development. It is also a powerful incentive to economic development. The process of providing better housing is a complex exercise in economic development. The achievement of better housing, in turn, has profound effects on social organization and political attitudes, which are the carriers and expediters of economic development.

In the U.S., the most important international agencies directly concerned with housing are the United Nations, the Organization of American States, the Inter-American Development Bank, and the Agency for International Development, which operates within the framework of the State Department.

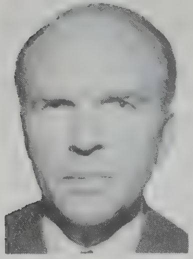
In addition to these entities, there is a long list of other agencies and governments which participate in one way or another in housing assistance, finance, or some other facet. These include:

- The World Bank and its subsidiary, the International Development Association (IDA).
- The International Council for Building Research Studies and Documentation (CIB).
- The World Health Organization.
- The Ford Foundation.
- The Peace Corps.
- The Caribbean Commission.
- Various economic commissions in Asia, Africa, and Latin America.
- Various agencies of foreign governments including the Soviet Union, Sweden, Denmark, Israel, the British Commonwealth Development Corporation, etc.
- The Export-Import Bank.
- Universities such as Harvard, Yale, Michigan, the Joint Center for Urban Studies at M.I.T., and others.
- U.S. Departments of Commerce and Agriculture.
- U.S. National League of Insured Savings.
- FHA International Division.
- U.S. Savings and Loan League.
- Office of International Affairs, Department of Housing and Urban Development (HUD).
- The Foundation for Cooperative Housing.
- The American Institute for Free Labor Development.

These are only some of the major organizations that are involved in housing in the developing nations. A complete, detailed list is beyond the scope of this paper.

These government, political, and financial institutions have pioneered the way and have developed an experience which can be extremely useful to the private sector. The need for greater professional involvement in this field, for more research in building materials and design, for developing new techniques in construction and administration of housing projects, and for lowering housing and site development costs to reach the lowest possible economic levels, is even more urgent in the developing societies.

The acrid smell of smoke still lingers in the ghettos of despair throughout this country; we cannot, therefore, expect apathy in the foreign ghettos, where conditions are considerably worse. The history of public housing in this, the wealthiest nation on earth, is not a happy one. We cannot expect public housing in the developing nations (which represents the bulk of housing construction in these countries) to do a more noteworthy job. It is apparent that the time has come for the U.S. private sector to get into the act affirmatively, and to exert its influence on governmental policies in this field. At a time when not only American principles, but others also, are increasingly questioned, and with the entire dispossessed segment of human society engaged actively in the "revolution of rising expectations," it is imperative that American talent, initiative, and capital be clearly utilized in our own national interest as well as that of all humanity. □



The United Nations' Role

by

Eric Carlson

Although there has been a relatively long history of interest in the housing sector from an international point of view, including that of the International Labour Office before World War I and the key role played after World War II by the Marshall-Plan-aided European reconstruction effort, to date international resources devoted to this sector have remained marginal and minimal. This is certainly true in comparison to those of the UN specialized agencies, such as the Food and Agricultural Organization, the World Health Organization, the Industrial Development Organization, which have been created for other fundamental areas of human need. This situation is paradoxical, especially in view of the fact that in many countries investment in the housing sector may run from 20 to 25% of total fixed capital formation—an investment having a tremendous impact on national economic and social development. On the global scene, we know also that we are facing a serious crisis in housing and urban development whose full effects the world has only recently begun to appreciate and to understand in its total dimensions. We must all share a strong sense of mutual responsibility in dealing decisively with the tasks that lie ahead, if the problems are not to grow to unmanageable proportions.

In too many developing countries, even minimal investments in the housing, building, and planning sector have been neglected in the past, in favour of investments in other sectors, which are characterized as more "productive." Yet, in some developing countries we now face the danger that slums and squatter areas, growing at the rate of 15 to 20% per year, may engulf existing urban and metropolitan areas before "normalized" patterns of institutional services can be made available to their inhabitants. It may very well be, as pointed out at a recent UN meeting on the problems of slums and squatter areas, that from here on, with the ever more rapid pace of urbanization in so many developing countries, a good portion of the world's population may never know decent housing, but is likely to pass through a transitional state in which illegalized land occupancy, or squatterdom, is considered ever more normal, and as the only way in which families can meet their housing needs in today's society.

Time and time again the responsible organs of the United Nations have called attention to the problem. There are a number of resolutions of the General Assembly and the Economic and Social Council which appeal in different ways for concerted national and international action, especially in the area of low-income housing. Increasingly, these resolutions are initiated and strongly supported by the developing countries, which are becoming ever more aware of some of the basic issues involved.

UN Programs in Housing, Building and Planning

First, a few words of explanation about the United Nations' concern with the housing, building and planning sector. Housing, building, and planning are among the many activities carried on by the United Nations. You will recall that the United Nations consists of six main organs, three of which (the General Assembly, the Economic and Social Council, and the Secretariat) include this field among their deliberations. The other three organs are the Security Council, the Trusteeship Council, and the International Court of Justice. The entire United Nations Organization is pledged in its Charter to promote, in economic and social terms:

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(a) Higher standards of living, full employment, and conditions of economic and social progress and development; (b) Solutions of international economic, social, health, and related problems.

The General Assembly and the Economic and Social Council, through their recommendations, influence the Member Governments' concepts of economic and social development as well as the Organization's overall policy and budget and the specialized agencies' administrative budgets. As such, they influence the Secretariat's housing, building, and planning programme.

Within the Secretariat, the Centre for Housing, Building and Planning, has the basic responsibility for this programme. The Centre is part of the Department of Economic and Social Affairs, and its work is closely related to that of other offices in the Department. The Centre also cooperates with many of the United Nations organizations and programmes.

Responsibilities of United Nations Bodies

The **General Assembly** may discuss any questions or matters, including housing, building, and planning. As an organ of the United Nations, it has as some of its functions and powers the responsibility of initiating studies and of making recommendations that will promote international economic and social cooperation. It receives and considers reports from the other United Nations organs, and it considers and approves the budget of the Organization as well as making recommendations on the administrative budgets of the specialized agencies. On economic and social matters, it deliberates on recommendations and draft conventions submitted to it by the Economic and Social Council (ECOSOC).

The **Economic and Social Council** (ECOSOC), on subjects falling within its competence, may make or initiate studies and reports and make recommendations to the General Assembly and to the Members of the United Nations. Also, it may coordinate the activities of the specialized agencies through recommendations to such agencies, to the General Assembly, and to Members. The specialized agencies are active in fields related to housing, building, and planning. The Economic and Social Council also arranges for consultation with international and national non-governmental agencies, and calls international conferences on matters within its competence. Furthermore, it may, with the approval of the General Assembly, perform services at the request of Members of the United Nations and at the request of the specialized agencies.

The housing problem continues throughout the world.

The Economic and Social Council is aided in its work by several expert bodies (commissions, subcommissions, and committees) which keep international problems in their respective fields under continuous review. They maintain close contact with the work of the Secretariat in their fields, study the problems and proposals referred to them by the Council, and submit to it detailed reports and recommendations.

The ECOSOC bodies which deliberate on housing, building, planning, and related problems are The Committee on Housing, Building and Planning and The Social Commission.

There are two other ECOSOC bodies which deliberate on subjects closely related to housing, building, and planning; The Statistical Commission (statistics relevant to housing), and The Population Commission (demographic aspects of housing and physical planning.)

Committee on Housing, Building and Planning

It might be well to focus attention on the first of the bodies mentioned, the U.N. Committee on Housing, Building and Planning. We should recall, first, that within the United Nations Secretariat a small unit was formed to deal with this sector in the late 1940's, and which later became the Housing, Building and Planning Branch of the Bureau of Social Affairs in the Department of Economic and Social Affairs. In the early years this unit was primarily occupied with substantive studies and research, to begin to build a "cohesive doctrine" and a certain position of leadership in the field, and provided a good deal of information exchange through seminars and publications, etc. As the importance of the sector became more evident, and on the recommendation of the Social Commission, a resolution was adopted by the Economic and Social Council on August 2, 1962 establishing a committee on Housing, Building and Planning, to provide stronger and more specialized leadership in this area.

The resolution further defined the terms of reference of the Committee, and established that it should report to ECOSOC through the Social Commission. It directed the Committee to also forward its report to the Committee for Industrial Development (which has since become a new specialized agency, the United Nations Industrial Development Organization) and to the regional economic commission for comments, so as to evolve the appropriate integration of housing and urban development programmes with economic, social, and industrial development programmes.

The terms of reference of the Committee on Housing, Building and Planning include responsibilities for:

1. (1) Examination of reports concerning technical assistance activities in the field of housing, building and related community facilities and physical planning;
2. (2) Recommendations for the Economic and Social Council's appropriate co-ordination of these programme among the various United Nations bodies, including the regional economic commissions, and with other international agencies;
3. (3) Recommending to Governments, through ECOSOC, the appropriate priorities and programmes in the field of housing and related community facilities and physical planning;
4. (4) Promotion of research and of the exchange and dissemination of experience and information in these fields, with special reference to the needs of under-developed countries;
5. (5) Development of proposals for consideration by appropriate United Nations bodies and others, on such matters as financing of home construction and ownership, provision of land for homes and community facilities at reasonable cost, designs suitable for low-cost housing in different climates and cultures, improved building materials and their better use, and ways of promoting acceptance and adoption of efficient organizational and building techniques; and,
6. (6) Development of means and methods for the increased utilization of regional economic commissions in these fields.

The Committee is composed of twenty-seven member Governments of the United Nations who (in accordance with operative paragraph 1 of the Council's resolution) are elected by ECOSOC for four-year terms on a basis of equitable geographical distribution and a balance between developing and industrialized countries. The Committee will now meet every two years, with its next session scheduled for 1969. There are no uniform criteria by which countries nominate their representatives to the Committee, and many are from disparate professions, although perhaps the majority have some official post in a national housing agency or national planning body, or else have a recognized technical competence in some aspect of the housing, building, or planning field.

The Center for Housing, Building and Planning

The establishment of the Centre for Housing, Building and Planning originated in recommendations made by the Committee on Housing, Building and Planning which were reviewed and endorsed by the Economic and Social Council. The Centre, which serves as Secretariat to the Committee, was officially established on June 23, 1965 when the Secretary-General directed that, in accordance with a resolution of the Economic and Social Council, the former Housing, Building and Planning Branch of the Bureau of Social Affairs be reconstituted as the Centre for Housing, Building and Planning within the Bureau of Social Affairs. The Centre now reports directly to the Under-Secretary for Economic and Social Affairs.

The Functions of the Centre are:

- To provide secretarial services and documentation for the Committee on Housing, Building and Planning and any ad hoc groups established in the housing field;
- To serve as the focal point for conducting housing, building and planning activities within the Secretariat, and for co-ordinating these activities with those of other agencies;
- To prepare special studies and reports and provide advice to Governments on housing, building, industrialization of building, urban and regional planning and physical planning aspects of urbanization;
- To organize inter-regional meetings and study tours on selected subjects related to housing, building and planning, and help to organize regional seminars and meetings on such subjects as the financing of housing, low-cost housing, urban and regional planning;
- To organize pilot projects in the field of housing, building and planning, including bilateral assistance provided under General Assembly resolution 1508 (XV);
- To review and provide evaluation of Special Fund and technical assistance project in the field of housing, building and planning.

The specific tasks to be undertaken by the Centre in relation to its general functions are defined by the Committee on Housing, Building and Planning through the work programmes which are adopted at each session.

At the present time the Centre consists of a Director's and Deputy Director's office and 4 substantive units: a housing section, a building section, a section for physical planning, and a research, training and information section. In 1968 the Centre had a total of 25 professional staff, 3 inter-regional advisers, and 3 technical advisers.

Unlike the early days, the bulk of the Centre's staff is presently devoted to planning, supervision, and review of technical assistance activities, including the Expanded Programme of Technical Assistance and the Special Fund projects. There is also growing stress on the importance of collaboration and coordination to be achieved through the regional economic commissions and other agencies.

Under the Regular Programme and the Technical Assistance component of the United Nations Development Programme, including funds-in-trust, 142 experts provided advice on various aspects of housing, building and planning to 57 different countries in 1967. The Centre also has responsibility for the review and placement of United Nations fellowships for this sector.

There is a clear tendency for technical assistance missions to develop into larger pre-investment projects to be financed under the Special Fund component. These projects tend to be larger in size and to run for three to five year periods, often involving UN contributions of over $500,000. They are of unusual diversity of approach, and may include the establishment of national research and training institutes, the organization of pilot project programmes, assistance in the planning or reconstruction of entire cities, towns and regions, and so forth.

United Nations technical assistance activities in the field of housing, building and planning continue to increase, particularly under the Special Fund component of the United Nations Development Programme. As of June, 1968, 18 projects had qualified for Special Fund assistance with a total value of about $16 million (under Special Fund earmarkings).

In order to promote the regional aspects of housing, building, and planning in the developing countries, a total of 8 Regional Advisers are attached to the Regional Economic Commissions for Africa, Asia and the Far East, and Latin America, and at the United Nations Economic and Social Office in Beirut for the Middle Eastern countries. Most of the regional commissions, with the exception of the Economic Commission for Latin America, have small units concerned with housing, building, and planning, and appropriate sub-committees or other bodies to deal with these matters.

In addition to these Regional Advisers, three Inter-regional Advisers in housing, building, and planning are attached to the Centre "to provide for specialist teams in housing, building, and planning to assist developing nations, at their request, in the establishment of basic housing, building and planning programmes and housing industries, drawing as appropriate on the resources of the United Nations programmes of technical assistance." Three Technical Advisers for Special Fund projects are also attached to the Centre.

While most of the requests for technical assistance start with individual experts to advise on specific aspects of housing, building, and planning, in a few instances requests have been received for teams of experts, consisting of physical planners, sociologists, transport specialists, economists, and sanitary engineers, to undertake short-term missions to assist in the formulation of comprehensive physical development plans. It is expected that the requests for teams of experts will increase as Governments become more aware of the need for formulating comprehensive plans to cope with the problems inherent in urban and regional development.

Of valuable aid to the technical co-operation programme has been the provision of 18 "associate experts" without cost to the United Nations by the Governments of Austria, Belgium, Denmark, the Netherlands, Norway, and Sweden to assist the United Nations experts in their assignments.

Trends in UN Programs

Although a great deal is being done by the United Nations Organization in the field of housing, building and planning, an even greater effort must be made in the next decade in view of the world population explosion, the rapid urban expansion, and the catastrophic growth of slums.

In commenting of the report of the Committee, both the Social Commission and the Economic and Social Council have urged that two projects be elevated to highest priority and the ECOSOC directed that it be done. These were, Project 2.8, Social Aspects of Housing and Urban Development, and Project 2.9, Design of Low-Cost Housing and Community Facilities.

A good deal of attention in the present two-year period will be given to the establishment of a programme of pilot projects designed to assist Member states in the improvement of living conditions in squatter settlements or slums of urban and rural

Demonstration of the CINVA developed Ram in a rural village.

areas. As the result of recent ECOSOC determinations, the Centre will also be exploring with governments the advisability of proclaiming an International Housing year, perhaps in 1971 or 1972, as part of an effort to focus world-wide attention on the acute social and economic problems associated with the lack of adequate housing. A working Party is to be established in Geneva to begin preparations for the establishment of an International Institute for Documentation on Housing, Building and Planning, whose headquarters eventually will be in New Delhi. On the project of housing finance, a major report will be completed in 1969, which will contain recommendations emanating from several advisory group meetings which have been held on this subject, and the work of consultants, including the possibilities for establishment of an international institution for housing finance, perhaps a World Housing Bank.

"New Development" Decade Strategy

As we approach the time of setting new goals for the second "Development Decade," 1970 to 1980, how shall we respond? Clearly, there must be more consistent and concentrated attention to the housing sector—as a key breeder of development—in all countries. This should be within the framework of a global strategy as outlined by Un Secretary-General, U Thant, in a recent statement, as follows:

> "First, the second Development Decade must be based on the concept of a global strategy, a strategy which recognizes that this small planet of ours—despite its divisions into North and South, into developed and developing, into rich and poor—is in fact an indivisible entity. That fact must be recognized. This global strategy must also recognize that humanity, despite its divisions on the basis of race, creed or religion, is an indivisible whole. . . .
>
> "Secondly, we have to remember that the national interest of any country cannot remain within the boundaries of its own territory. . . . The future of every nation depends primarily on international security, international peace and the development of international resources. . . .
>
> "Thirdly, humanity has now reached the crossroads of human history. This is a time when both the developed and the developing countries have to make a choice: either to come together to plan for a prosperous future to their mutual benefit, or to lead humanity to an unplanned society and to a chaotic future. That is the choice before both the developed and the developing countries. If common sense prevails the choice of both the developed and the developing countries will, I am sure, be to plan collectively for mutual prosperity."

Unfortunately, we are in a period when there is a general slackening off of foreign aid efforts through the allocation of public budgetary resources. The housing sector for a while received a notable shot-in-the-arm, particularly in Latin America through the lending programmes of the Agency for International Development and the Inter-American Development Bank. But much of this is being suspended, to be replaced by the various insurance and private investment guaranty programs which have been authorized for the housing sector by the U.S. government under certain conditions and amounts.

At the recent Second United Nations Conference on Trade and Development held in New Delhi in February-March 1968, the developed market-economy countries acknowledged their obligation to transfer to the developing countries not only one per cent of their gross national product but indeed an ever-rising percentage of their annual production. Obviously, there will be questions of when deadlines can be accepted for such commitments by particular countries in view of balance of payments problems. While the principles are becoming established, these must be coupled with realistic approaches and assessments of the role of foreign aid or external assistance to the developing countries.

Technology and Challenge

There is no doubt that we stand at the threshold of a new era for housing and urban development everywhere, and in the developing countries in particular, an era which will present major challenges to governments as well as to international organizations.

Although the housing situation to many developing countries may appear hopeless because the likelihood seems remote for increasing investment in this sector, it should be pointed out that with a firm and well-oriented program, the dynamics of development will inevitably bring about possibilities for quantitative expansion in available national resources. Certainly, much more strategic direction and planning should be applied to the resources being expended in this sector.

The opportunity exists, here and now, to begin to use the experience that has been accumulated to date in this field in various countries of the world to develop broad new institutional approaches for continuing and accelerating action for housing and community improvement programmes.

To be effective, these programmes are likely to involve public and private collaboration on an unprecedented scale, in various combinations of mutual aid among international and national agencies. There must be a recognition of the inherent dignity of man which must be represented in the works created for and by him through a "design initiative," incorporating new social architecture and environmental engineering concepts.

We are fast approaching a stage where new multilateral corporate structures must be devised that will provide continuity of experience, administrative capability, and a framework of performance incentives for the accomplishment of specific programs and projects in the developing countries.

Such joint development corporations, to be chartered for certain time periods by the countries at whose request they are to serve, will provide more than seed capital—they will also provide seed management capable of integrating and advancing personnel of the developing countries within a well formed international career structure. Perhaps in no other field are the possibilities so great for the formation of such corporations as in the sector of housing and urban development, where the international and national needs and opportunities are causing deepening public concern. This is the task of the future—to construct an international framework under which both capital and human resources can be more effectively mobilized to take proper advantage of the world's seemingly unlimited energy potential and its overall rapid growth in productive capacity so that the neglected field of housing and urban development will also enjoy its share of world progress.

A fundamental philosophy must be brought to bear—that people's thrift institutions should invest a far greater portion of their assets—be they insurance companies, savings banks, building societies, cooperatives, etc.—in projects and programmes that will work for the overall benefit of their saver-owners: namely, the promotion of world security and the retention of values of democratic societies. In some cases, special legislation will be required to permit the investment of at least some specified percentage of the assets of these thrift institutions in the development work, through the purchase of obligations, of an international housing national housing bank, for example. Obviously, this type of investment, while serving public purposes, would also help to relieve the pressures for increased direct budgetary appropriations for international development. It would in any event have to be accompanied by appropriate technical assistance measures.

Nothing can be accomplished, however, unless an adequate professional infrastructure is created to deal with the problem. There is no doubt that in the years ahead the "action" in the building research field will be found in the developing countries, where new methods and materials can be tried and tested, and where so-called intermediate technologies will find a new foothold. In the past, suggestions have been made that a percentage of all loans or aids for the housing sector be devoted to training and research efforts for the creation of the professional and technological infrastructure that is required for steady advance. These suggestions have not fallen on fertile ground. Perhaps we should propose instead that the private sectors most concerned with building research and technology might do well to create or to establish an **International Housing Research Fund** which could be used to promote and to strengthen, through universities or other institutions, interchange of experience that will help in developing a community of knowledge and interest in the broader aspects of urbanization and a methodology comprehensive enough to deal with it in an interdisciplinary way, on a worldwide basis. Such core programs can and must be built up with close links to the national agencies or institutes of housing that have now been created in virtually all countries. From them will come the basic data required to formulate the industrial production requirements for major housing and building efforts attuned to each country's needs.

The United Nations is keenly interested in this type of approach to technology, and would hope that the efforts of organizations such as the Building Research Institute could be directed in part to providing new solutions valid for the developing countries, especially in the housing, building and planning sector.

As with most situations of human advance, a middle way must be found and given due recognition which will incorporate certain features of modern technology, but not to the total detriment of all existing systems for the more nationalized use of existing building systems and materials.

It is time that the private sector assumed a greater role and responsibility for meeting the needs, the demands, and the opportunities inherent in this whole sector of activity. As indicated, new instrumentalities are essential, both financial and administrative, at national and international levels. They will not succeed, however, unless they are accompanied by a vigorous awareness, understanding, and commitment by the private and entrepreneurial sectors to get on with the job, in full recognition of its importance for planetary survival and for continuing growth.

This is not a question of a charity approach to world development. One developing country after another is achieving significant new levels of progress, and control of its environmental resources and possibilities, and showing the way with imaginative new patterns and programmes. It is important to look at this scene not from a viewpoint of smug provincialism, but rather to share fully in the advantages of the exciting participative ventures that are opening up with the spread of the new planetary society over the globe's surface.

As an instrumentality of the Member States, the United Nations will undoubtedly continue to be seized with the problems of building and dwellings for the world's population. But all its efforts must go hand in hand with an unprecedented mobilization of non-governmental and private resources if successful results are to be achieved. ☐

The Role of the Inter-American Development Bank

by

Henri Scioville-Samper

The world was inhabited in the year 1800 by about 900 million people. By 1950 its population amounted to some 2.5 billion. It may grow to as much as 6 billion by the end of the century. Between 1800 and 1950 the population living in cities of at least 100 thousand inhabitants grew from 16 to almost 314 million, or about twenty times in 150 years. At present, about 60 million people are being added to the world total every year. World population is now doubling in size every twenty-three years or so, with the greatest growth occurring in urban areas, especially in the large cities.

Uncontrolled urbanization is acquiring dire international proportions. Its urgency is heightened by the fact that the government leaders concerned have not yet fully recognized the glaring imbalance between resources being allocated to urban development programs and to other priorities. The condition is urgent because organization methods for coping with the on-rush to cities are not satisfactorily established or proven.

Although various census and studies on housing and population have been carried out in most Latin America countries, it is still difficult to establish the true magnitude of the region's overall requirements. We can estimate, however, that the total housing shortage for these countries is on the order of 15 million units. Minimum cost is about 24 billion U.S. dollars (approximately 34% of the 1962 gross national product), according to IA-ECOSOC, Lima, 1964.

The term "housing shortage" is a relative concept. Its magnitude depends on the criteria by which it is measured in each individual case. When it is borne in mind that, except in cases of absolute deprivation, every family has some kind of roof over its head, the requirements estimated for each country become, in the last analysis, qualitative, and the volume greater or lesser depending on the yardstick employed. Shortage takes the form of crowding and promiscuity, inadequate protection against the rigors of the elements, lack of basic sanitary services and, in general, an absence of the minimum physical accommodations regarded as suitable for human habitation.

The pace of housing construction that would have to be sustained to supply the needs of overall Latin American growth is some 10 housing units per thousand inhabitants per year. The enormity of the problem is conveyed by the fact that today only 6 or 7 housing units per thousand inhabitants are built yearly in all but a very few of the highly developed countries. Close to 2½ million units would have to be constructed each year to eliminate within 30 years the aforementioned housing shortage of about 15 million units. At the same time, the needs generated by population growth and for the replacement of dilapidated units would have to be supplied. In other words, we would have to build between 11 and 13 housing units per thousand inhabitants per year. In Latin America, urban population is growing at a cumulative rate of more than 4% per annume (6% and 8% in many of the large cities), but only about 2 housing units per thousand inhabitants are now being constructed.

Housing and Economic Development

Supply tends to lag behind demand in housing and urban development either because there are not enough resources to meet the growing needs or because the resources available are not being used to maximum effect. It is also obvious that since there are other equally urgent needs, conditions may grow even worse in many countries before the pace of housing construction can be significantly stepped up.

Urbanization is outpacing industrialization. To remedy present social ills at the expense of industrial and agricultural productivity is to condemn the

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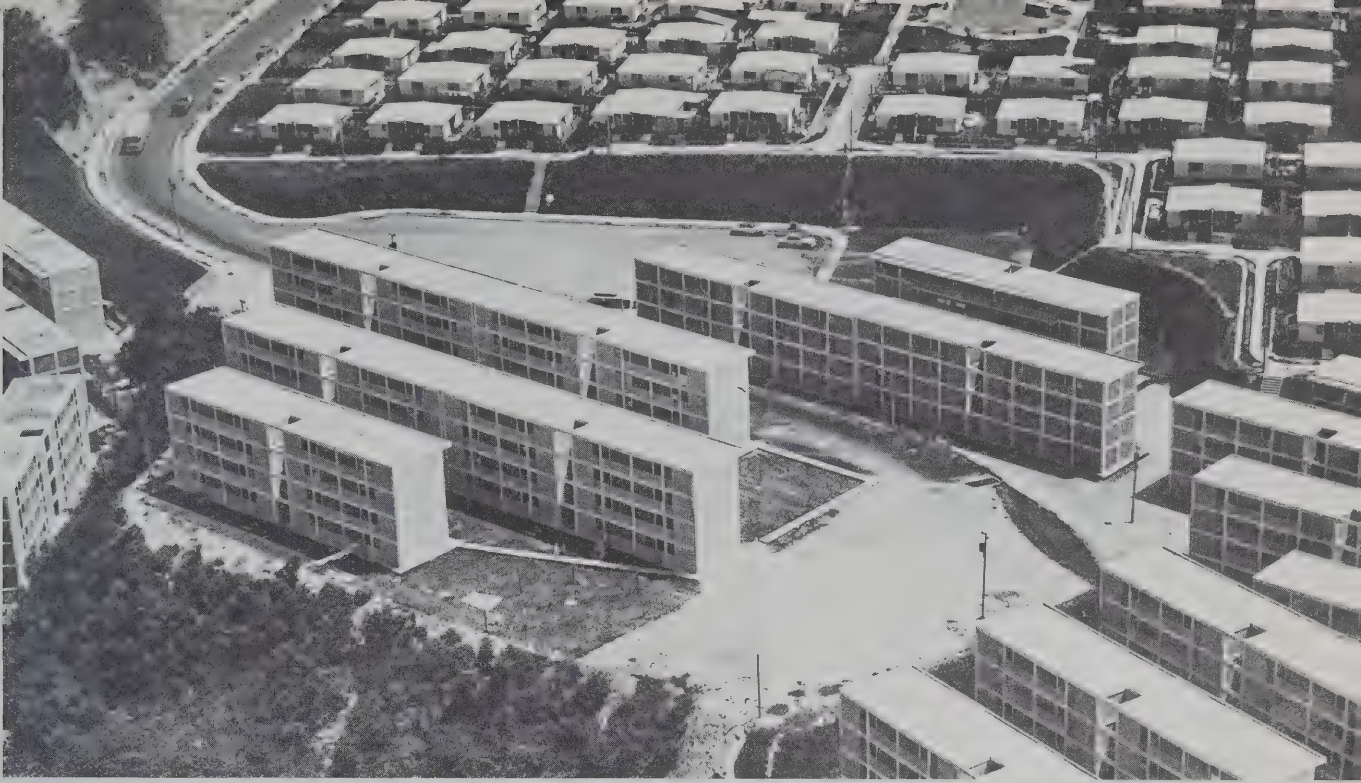

A low-cost housing project in Ecuador.

population to decades of low living standards. The dire needs of the population cannot be ignored. Therefore, investments of social capital may be essential if productivity is to be increased.

The principal issue for the developing countries is the assessment of the appropriate share of national resources to housing and urban development in connection with and as a basis for industrialization and agricultural development.

The Latin American countries had for some time been energetically seeking financial support to reduce the aforementioned housing shortages, but with no success.

Up to that time, expenditures for housing were regarded exclusively as a social investment. This criterion has been modified. Economists and statesmen today accept expenditures on housing and related services as an economically productive investment. For example, the security and stability that derive from the possession of one's own home significantly increases labor productivity and efficiency.

Today the construction industry stands out as one of the most dynamic forces in the economy of a country. It has undergone an appreciable growth, particularly in the last few years, with an extraordinary increase in the size of firms producing materials and in the hiring of working-age people at all occupational levels.

It is important to note that the sector of the construction industry which is most dynamic and most effectively contributes to economic development is housing. It is only fair to acknowledge its share in the formation of gross domestic product (the value attributable to the factors of production, which consists of the sum of added values, labor remuneration, profits, etc., generated within each country) and in domestic capital formation (gross domestic investment whose components are added inventory and gross domestic fixed capital formation, defined as the value of structures, works, transportation equipment, machinery and other fixed assets purchased or bought by individuals, firms, non-profit private institutions, and government). It also includes family expenditures on new housing.

The Social Progress Trust Fund

The Tenth Inter-American Conference at Caracas in 1954 recognized housing as one of the most serious and urgent problems confronting the hemisphere. Specifically, it was accepted that "housing belongs with education and health in the category of the so called 'social infrastructure' projects, which are regarded as fundamental to economic development. In this sense they may be compared with "economic infrastructure" projects, such as those of transportation, communications, and electric power which are generally regarded as indispensable for the achievement of real economic development. These infrastructure projects generate little or no foreign exchange earnings. They generally yield meager benefits in the short run and take a long time to return a financial profit. However, their utility consists in that through them a more balanced development of economic activity is achieved." (Financing of Housing and Community Improvements Programmes, U.N., 1957).

Later, in the Act of Bogota of September 1960, the Committee of 21 laid the foundations on which to establish an inter-American program designed to "improve housing and community services." It was then that the United States Government announced the establishment of a fund for upcoming social development programs which would include housing programs. The idea that the Inter-American Development Bank, which was to go into operation weeks later, should be made the principal mechanism for the administration of that fund was very well received.

These events led to the signing in June 1961 of a contract between the United States Government and the Inter-American Development Bank for the administration of the Social Progress Trust Fund of $394 million (U.S. dollars) to provide financing in four basic fields of action in social development: land settlement and improved land use; low-income housing; community, sanitary and water supply facilities; and complementary financing of facilities for advanced education and training.

Under an additional protocol signed by the contracting parties in February 1964, the United States Government added $131 million (U.S. dollars) to the Fund, thus raising its resources to a total of $525 million (U.S. dollars).

Inter-American Development Bank (IDB)

The establishment of the social progress Trust Fund made it possible to launch an extensive housing program in the countries of Latin America. When it began operating in this new field along the usual lines of international financing agencies, the IDB adopted the following basic guidelines for its operations in housing and urban development:

1. The loans granted were to promote the mobilization of domestic resources.
2. The programs were to provide inexpensive housing for low- or middle-income families.
3. To the extent possible, each operation would be related to an extensive national housing program.
4. In every project, the borrower would employ the self-help system as far as practicable.
5. Every project should launch, continue, or reinforce a program that could later become self-sustaining (i.e., be operated without external aid).
6. Every project should lead to private ownership of the homes provided.

The 59 current loans (sum total of about 300 million dollars), devoted entirely or in part to housing constitute one of the most substantial headings among the IDB's general operations. When combined with the domestic resources contractually committed by the countries for the same housing purposes, an aggregate investment of more than $616 million is in effect. These funds are being used to build about 320,000 housing units for approximately two million people. Completion of this effort is expected in the next two years.

As of 31 December 1967 the following progress had been made under these loans: Housing units in process of bidding, 5,771; Housing units under construction, 30,342; Housing units completed, 185,841.

Entry of IDB into the low-cost housing field has led to an increase in the number of housing units, but more importantly, the resources lent are contributing to the achievement of institutional improvements. This financial aid has contributed to:

- The formulation of adjustment and the execution of national housing plans in 15 countries
- The creation of new national housing agencies in 4 countries
- The revision (through IDB technical assistance) of operating practices of housing institutions in 14 countries
- The introduction or expansion of the savings and loan system, and the establishment in nine countries of mortgage insurance through technical assistance (another 5 countries have requested this assistance).

Specialized agencies, with basic responsibility for the programming of housing development, are today functioning in all IDB member countries except Haiti. The emergence of these institutions has helped technical planning and the channeling of local and foreign resources into this field.

The creation and strengthening of agencies is highly important since it is no easy task, even with available resources, to reduce to any considerable extent the housing shortage that has been forced upon us.

Despite the important physical results obtained from current investment and local contributions, the Inter-American Development Bank is not losing sight of the real scale of the problem, and is not pretending that financial assistance alone is capable of solving the housing problems of Latin America. To the contrary, the philosophy underlying the lending policy of the Bank in this field, as defined by its President, Felipe Herrera, is that housing loans are no more than a kind of seed capital intended to reinforce the efforts of governments and citizens.

Most IDB loans contain an item for technical assistance as a contribution to the improvement of the technical, financial, socio-economic, administrative, or other aspects of the borrower institution in which such improvement is felt to be necessary.

Technical assistance operations are classified under two headings: 1) direct technical assistance; and 2) training and other activities. Direct technical assistance can be reimbursable with or without interest, nonreimbursable, or of contingent recovery. The last is granted as nonreimbursable assistance, but is subject to the condition that if it leads to the subsequent granting by the IDB of a loan to the beneficiary institution, the amount of that assistance will be made a part of the loan for reimbursement to the Bank.

These technical assistance programs have exerted a great impact on housing construction technology and in the installation of sanitary services. They have also contributed to the laying down of administrative rules and procedures for the awarding of works contracts, with procurement of materials, etc., and the selection and awarding of housing units to the ultimate beneficiaries.

Fund for Special Operations

As of 31 August 1966 the IDB had authorized from the Social Progress Trust Fund loans aggregating about $502 million (U.S. dollars), thereby almost fully committing the $525 million put up by the United States.

The resolution of the Board of Governors directing an increase of $900 million U.S. dollars in the resources of the Fund for Special Operations broadened its field of activity to include *"financing for social development purposes, including those heretofore financed through the Social Progress Trust Fund."*

This resolution also provided that in establishing financial policies for the enlarged Fund, the Board of Executive Directors was to take into consideration the policies that have guided the operations of the Trust Fund.

The Role of Private Enterprise

In order to raise the purchasing power of the consumer and to lower production costs, substantial investments are needed to create more sources of long-term credit and to stabilize and enhance the productivity of the construction industry.

These investments elicit the strongest opposition from those who feel that because available resources are so scarce, they should be allocated to investments offering a higher economic return over the shorter run.

The need to alleviate the current housing shortage is, however, an urgent problem that calls for immediate action without waiting for general economic conditions to reach an "ideal point of development" at which resources can be funneled into activities of social content.

Analysis of the sources and structure of gross investment in Latin America commonly reveals that only 10%, and perhaps even less, originates in contributions from outside, while the rest is generated by activities within the countries themselves. Thus, the main difficulty lies not in the origin of the capital but in its paucity in the face of the enormous development needs of the area. Hence, any effort, such as the creation of the Mortgage Credit Insurance System and the subsequent establishment of the Secondary Mortgage Market, which helps increase the volume of investment is of great importance to us.

There is a close relationship between local funds and external financing. As a rule, external private money is associated with the resources of domestic businessmen, and it almost always happens that the countries with the greatest saving capacity attract the greatest volume of foreign resources.

In view of these objective facts, all those economic and financial instruments which facilitate and materialize the saving-investment process are of key importance for the progress of our countries.

The institutional framework now being created and developed in our countries must be consolidated by cooperating in the expansion of those financial systems, improving those which are poorly organized, and fostering their creation where they do not yet exist.

The financial institutions which constitute this institutional framework are as follows: (a) Private institutions, such as savings and loan associations, or specialized mortgage banks; (b) Government institutions in charge of establishing the mortgage credit insurance system, which secures investments in this field against loss (This is the cornerstone for building an efficient secondary mortgage market.)

The IDB has rendered and continues to render technical assistance in the savings and loan field and in the creation of mortgage insurance systems and mechanisms conducive to the establishment of secondary mortgage markets as a complement without which the prospects for the success of the savings and loan system in our environment would be slim indeed.

Moreover, the IDB has joined with the AID, the National League and the Inter-American Union to sponsor inter-American meetings designed to foster the spread of the savings and loan system based on free (as opposed to contractual) savings.

The savings and loan system is a highly effective device for cooperation in the solution of the housing problems of our countries, but it is necessary that it be complemented with a mortgage insurance system so that the government may, through an institution created for the purpose, guarantee for the creditor or the holder of a credit in due course the collection of the principal owed plus the interest and other obligations accruing under the credit. Such a course, as we have been saying, favors the establishment of a sound secondary mortgage market which multiplies the financing capability of the associations or mortgage institutions that generate credits.

Construction and Integration

It must be acknowledged that construction is probably the economic sector that lends itself least to integration, at least at its present technological level. The considerable weight of construction material and the fixed nature of housing units and services actually hamper the mobility of that material. International movements of some construction materials, such as cement, electric wire, glass or locks, constitute temporary flows of goods that are generated by more or less unforeseen spates of demand, and fall off steeply when the mechanics of the recipient local market generate the corresponding corrections on the supply side. Some materials, such as building lumber, may continue to be traded favorably on the international market (as is the case in Central America), but this material may be the only exception to the rule.

On the other hand, if traditional construction systems evolve toward the intensive use of materials and systems produced by a highly specialized industry, conditions might be generated that would be much more favorable to economic integration. It is easy to foresee the appearance of new construction materials demanding high concentrations of technology and capital, and, therefore, achieving economies of scale unattainable at any building site.

Prefabrication

Since the beginning of our operations a prefabrication system has been sought which would work in Latin America. As of this date we have yet to see or hear of a system that can do the job.

Our approach to the problem has been open-minded receptivity to reasonable suggestions, with no limitations on the technical solutions or on specific design criteria of the housing units. Acceptability of modular coordination has been emphasized since there are no serious problems on building codes in Latin America. The problem of building-trade unions in relation to prefabrication is non-existent. Within these guidelines we have set up a framework for finding one or several possible solutions that can withstand analysis.

It would be very useful to mention several important requirements that any prefabrication system must meet to be feasible in Latin America. These basic concepts, which to our way of thinking could define a good prefabricating system for Latin America and would make a strong case for any proposal that incorporated them, are as follows:

- REASONABLE INVESTMENT. The need for heavy outlay of dollar resources on the part of our developing countries to purchase heavy equipment and components renders any system incapable of facing cost competition from traditional construction systems (especially when recuperation of these large investments is planned within a short period of time), thus increasing final costs to uncompetitive limits.
- TECHNICAL SIMPLICITY. Prefabrication should provide simple technical solutions for temporary installations and for transfer of simple production centers to different and often distant places where housing is needed in relatively small numbers.
- USER ACCEPTABILITY. The houses should suit the respective cultural and social requirements of each country. In this regard, the selection of a good architect for preventing esthetic excesses in building often seems to be in order.
- UNIT COST. Even though prefabricated houses do not require a complex assembly line, are rather easy to erect, and do not look out of place in the neighborhood, the final product has never been shown to us to be less expensive than what can be produced under similar conditions with traditional procedures. In other words, construction costs in New Jersey, Illinois, or California, do not mean very much in terms of building that same house in Asunción, Paraguay, or in Arequipa, Peru.

Even if we are interested in utilizing improved building methods and in promoting technological systems, these points—reasonable investment, technical simplicity, user's acceptability, unit cost—and similar issues should be explored in depth before we can recognize that we have arrived at a solution for prefabrication suitable for Latin America.

Outlook for Future Action

As we view the magnitude of the social problem posed by the disorderly growth of our cities and the scarcity of housing, we must conclude that there is no single magical solution. But we do hope that from the efforts of each nation the effective collaboration between public and private sectors, and the aid forthcoming from international agencies, elements capable of meeting the challenge of our time will emerge.

The materialization of a mortgage market on the national, and perhaps later on the regional level, is a matter which has profoundly interested us.

The fundamental question of development is the problem of integrating rapidly and organically a scientific and technical revolution into the faster-paced process of social transformation.

Development is essentially a human experience, and as such implies human desire, human sensibility, and human capacity. It implies social organization and individual strength, in terms of training and creativity, to yield material results. More than anything else, development is perhaps a process that alters attitudes and enhances aptitudes for purposes that are as much spiritual as material. It is a process of improvisation and constant adaptation to the physical environment of each country.

What has to be done in this field of the financing of housing is to plan and implement a social transformation based on the assimilation and entrenchment of new financing techniques.

The Inter-American Development Bank is prepared to cooperate fully in achieving these ends. Thus, it will be fulfilling its mission as an institution conceived to join in the development efforts of our countries and communities. □

The Role of the Organization of American States

by

Philip Huber

The Organization of American States (OAS) is an organization of 22 countries that includes the United States, the countries of Latin America, Trinidad and Tobago, and Barbados. Although the OAS was created in 1948, the Pan American Union (PAU), which is today the General Secretariat of the OAS, has been in existence since 1898.

Broadly stated, the purpose of the OAS is to maintain the peace and security of its member states and to promote, through cooperative action, their economic, social, and cultural development. Housing, and urban development in general, are considered part of the social sector and are assigned to the Department of Social Affairs. It is important to note that the OAS is essentially a political organization; it seeks to achieve its ends by working with and through the member governments. In both housing and urban development, we therefore deal principally with government-sponsored housing and urban development programs. It is also important to note that the OAS is not a banking or lending organization. These functions are managed by the Inter-American Development Bank and by AID, both of which grant long-term loans for public housing and related community facilities. OAS funds come from quotas assigned to the member governments. Needless to say, there never seems to be enough money to accomplish all needed services.

The role of the OAS in promoting economic and social development is governed, generally, by the principles and objectives of the Alliance for Progress. The policy-making organs in this field are the Inter-American Economic and Social Council, which meets once a year, and the Inter-American Committee on the Alliance for Progress, which is its permanent body. The Committee—known as CIAP—monitors the countries' progress in meeting the objectives of the Alliance and the lending policies of the external financing agencies. The PAU serves as the secretariat of both these organs.

In the specific field of housing, the OAS has a half a dozen or more objectives and functions. These are:

First, to cooperate with institutions in the member states, both governmental and non-governmental, by providing them with technical assistance when requested. The missions we send normally cover a three month period, but may be extended. Depending on specific requirements and on staff availability, we either use members of our own Program of Housing and Urban Development or outside experts. As examples of the range of technical assistance, during the past year we have helped one country develop a national school construction program, advised another on recovery from housing devastation caused by a hurricane, and assisted a third with an urban renovation

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The OAS Inter-American Housing and Planning Center (CINVA) in Bogotá, Colombia. It is one of the field operations of the OAS Program of Housing and Urban Development.

scheme.

Second, training. For some time this has been the principal OAS activity. We have several resources to draw on, the most important being our Inter-American Housing and Planning Center (CINVA). It is located in Bogotá, Colombia. CINVA offers a regular 6-month course for advanced professional training, and short courses in such subjects as self-help housing, rural housing, cooperative housing, improvement of slum areas, and housing finance. These short courses are normally given outside of Bogotá (often as a practical course related to an actual project), as was the case of the last course in self-help housing given in Venezuela, as well as a rural housing course given in Ecuador. For professional training in urban and regional planning, we have another Inter-American program, known as PIAPUR, located in Lima, Peru. It offers a regular 1-year course plus shorter national and regional courses.

Through the OAS Special Training Program, short courses—ranging in length from 3 to 9 months—are offered in countries outside the Western Hemisphere. This year's courses cover heavy concrete construction at the Instituto Torroja in Madrid; building productivity at the Bouwcentrum in Rotterdam; industrialized building in Copenhagen; cooperative housing in Israel; and urban planning in England. Through another OAS program, fellowships are awarded for graduate education in the United States and Latin America in architecture, city planning, housing, and so forth. The purpose of these housing training activities is to help meet the technical staff needs of public agencies in our member states.

Third, to carry out research. The purposes here are to raise the technical performance of institutions and professionals, and to keep abreast of problems, accomplishments, and needs in the member states. We are now in the process of publishing a third study in a series of comprehensive studies on housing. This volume will deal with housing in Panama. The first two volumes were on Peru and Honduras. In addition, for the past year we have been developing a special project for the purpose of assembling data on housing and urban development in such a way that we can maintain up-to-date and panoramic knowledge of what is happening in all the countries. This information is expected to be useful to other organizations as well as to OAS. We also have extensive research programs in housing and related fields at our Housing Center (CINVA) in Bogotá, Colombia, and at our Urban and Regional Planning Program (PIAPUR) in Lima, Peru. Research fellowships at CINVA are granted each year for directed research in specific areas. At present, we are concentrating on industrialized building, particularly as it relates to market employment considerations.

Fourth, to organize conferences, meetings, and seminars—international, regional, and national—on both technical and policy matters. We have just concluded a major meeting on urban and regional planning. Currently we are collaborating with the National Housing Finance Agency of El Salvador to offer a one-week seminar for the Central American region on multi-family condominium housing. A major technical meeting on housing and urban development is scheduled to be held in Rio de Janeiro in October of this year. We also participate in many meetings and seminars organized by other institutions.

Fifth, to publish, exchange, and distribute material on housing. In doing this we provide a much-needed service to the countries. We try to keep them informed on what other countries are doing and on new techniques and concepts in the field.

Furthermore, as part of the CIAP secretariat, we are responsible for reporting conditions in housing and urban development for CIAP's annual studies, and on economic and social progress achieved by each of the member states. Last year we reviewed the housing situation in four countries; this year we will do a review in depth of Trinidad and Tobago and El Salvador, and a less comprehensive one on Ecuador. For last year's meeting of the Inter-American Economic and Social Council we prepared a major policy document on social aspects of urban development.

Our Program also acts as the executive secretariat of the Inter-Agency Coordinating Committee on Housing and Urban Development, which was formed in 1964 to coordinate the programs of the international agencies. Besides the OAS, the Committee is composed of the Agency for International Development, the Inter-American Development Bank, the United Nations and its Economic Commission for Latin America, and the Pan American Health Organization.

This Committee is jointly sponsoring an experimental project in Central America and Panama to reduce housing costs through new methods and materials of construction. Last summer, for four months, five experts were sent to the region to work with the national housing institutions in developing their respective projects. These projects are being financed through regular loans of the Inter-American Development Bank. Last November all of the twenty-odd agencies involved in this venture met in San Salvador to discuss the proposed plans. Construction is now underway in each of the six participating countries and should be finished late this year. An initial evaluation of the completed projects will be made, and then a second meeting will be held in late 1968 or early 1969 in Tegucigalpa. The report of the project will be distributed to all the member states for their information and use.

In view of the impressive success of this collaborative venture (many told us it would never work) our Committee is now well advanced in the planning stages of a second interagency experimental project. We have an excellent proposal from a Pan American Health Organization rural architect, currently stationed in Venezuela, for a project in rural housing and settlement planning, which has been drawn in part from the outstanding Israeli experience in this field. The project would be undertaken simultaneously in two or three countries having similar rural conditions (perhaps 3 Andean countries). Again, the results would be published and distributed throughout the hemisphere.

While the objectives of the OAS in housing—and its functions as described above—are continuing, the role of the OAS in housing is not a static one. As the conditions and needs of the member states change, so must our role and functions change. Indeed, we know that we must increasingly anticipate changes, articulate them, and guide the member states in bringing them about.

For example, we are restructuring our CINVA housing center. We have also adopted industrialized building as our main topic for both training and research for the next 3-4 years. This is being done because we believe that only through modern techniques of mass building can the urban housing needs of Latin America be satisfactorily met. In the past the argument has often been used that traditional building methods are cheaper, are more acceptable to the tradition-minded lower classes, and provide a major source of employment for unskilled workers. These reasons are important; but the housing needs of Latin America are becoming so enormous that we can no longer allow this particular aspect of underdevelopment to continue. The barriers to new methods and materials must be broken down—just as they must be broken down in this country—if we ever hope to meet the housing needs of lower income people.

While the OAS must, by the nature of its objectives and organization, deal principally with the public sector—that is, government housing institutions—it must also be very conscious of the need for increased private sector participation in meeting the housing needs of the lower-income groups. There are many obstacles to greater active participation by the private sector: the shortage of long-term financing, political instability, inflation, lack of factual data on the nature and size of effective demand, very high land costs, and, of course, the sheer lack of available capital for housing.

Despite these obstacles, numerous low-cost urban housing units are being constructed by U.S. builders under the AID investment guarantee program. For example, Hogares del Norte, headed by Howard Wenzel, IBEC, World Homes, Inc., has successfully entered this market in some Latin American countries; but it is a risky business that requires both political dexterity and an ability to assess local demand.

Many other U.S. builders and purveyors of new construction systems and materials are probing the Latin American market. Many come to us for advice and assistance. Most leave disappointed that we cannot provide them with detailed market advice, or that we cannot act as an intermediary in opening official doors, or even in sponsoring project demonstrations for their product. On the other hand, it is difficult to understand why the American building industry, which must be the most affluent in the world, is so ill-equipped to deal with Latin America; and further, why it has made no substantial effort to help the Latin Americans to solve their housing problems by themselves. The attitude most often encountered is: How can we tap this big market for our own profit? As a result, American housing investments are not always looked upon kindly by Latin Americans. A second result is that the countries are turning increasingly to Europe for advice on housing policy and technology. There is no central organization in the United States to which the OAS, for example, can turn to obtain names of experts who can advise it on the various aspects of housing in Latin America. Nor do we find any major non-profit, non-commercial housing center in the U.S. that carries out research in low-cost housing. For all its vaunted technical ingenuity and creative enterprise, the United States seems far behind in low-cost home-building technology. As a result, Latin Americans are reading, more and more, about what is being done in Sweden, Germany, Poland, France, England, Israel, than what is being done in the United States.

The absence of such a housing center—one without any substantial vested interests—may be due in part to the lamentable attitude toward low-cost housing research that seems to prevail in so many quarters these days. What is needed is action; but not the kind of sporadic action that has characterized many housing programs in Latin America. Much additional research—methodological and technological—is needed in such areas as housing programming, housing administration, housing renovation, and new methods and materials of construction.

The establishment of a U.S. housing center could contribute significantly to this needed research. It could organize and coordinate U.S. technical assistance for Latin America and other developing areas of the world, in addition to providing training and documentation services. Such a center would promote in the best way U.S. methods and materials.

In conclusion, it is urged that the Building Research Institute use its influence to create such a housing research and training center, and that it seek the advice and collaboration of the OAS and other inter-American and international organizations in setting up those elements pertaining to Latin America. ☐

The Research Role of the Agency for International Development

by

Osborne T. Boyd

A basic and pressing problem facing every developing country is how to cope with the unprecedented growth of urban areas. It is estimated that the total population in less developed countries will increase by 40% in 15 years—but the number of urban dwellers in these countries will double in the same short period. As agricultural productivity increases, the migration to cities will accelerate.

An urban crisis of this magnitude—and no other word adequately describes the situation—is giving rise to a host of development problems. Effective local and regional planning, adequate land use controls, essential municipal services, and housing are all urgent, high priority needs.

A development program which ignores the problem of urbanization is not complete. National programs which will facilitate private and public activity, development of institutions, trained personnel and processes required to plan, regulate and build urban areas—and to provide such urban areas with an appropriate level of municipal services, will contribute to the achievement of economic and social development goals.

Legislative guidance for A.I.D.'s housing and urban development activities is provided in Sections 102, 221, 224, and 601, of the Foreign Assistance Act of 1961, as amended. Under "Statement of Policy" in Section 102, Congress has declared "the highest possible emphasis should be given to programs providing for loans or loan guarantees for use by institutions and organizations in making repayable low-interest rate loans to individuals in friendly foreign countries for the purchase of small farms, the purchase of homes. . . ."

Section 221 provides "where the President determines such actions to be important to the furtherance of the purposes of this title, assuring against loss of any loan investment for housing projects with appropriate participation by the private investor in the loan risk." This provision in effect gives a special preference to investment guarantees for housing projects over and above the usual 75% limitation covering other types of all risk investment guarantees. This section also authorizes a total of $300 million of such all risk investment guarantees and Section 224 authorizes a total of $400 million for housing projects in Latin America.

Under Section 224 we may, in Latin America, issue guaranties to U.S. investors in loan investments in pilot or demonstration housing projects; credit institutions, such as savings and loan associations; housing projects for lower income families; housing which will help the development of institutions important to the success of the Alliance for Progress, such as free labor unions, coopera-

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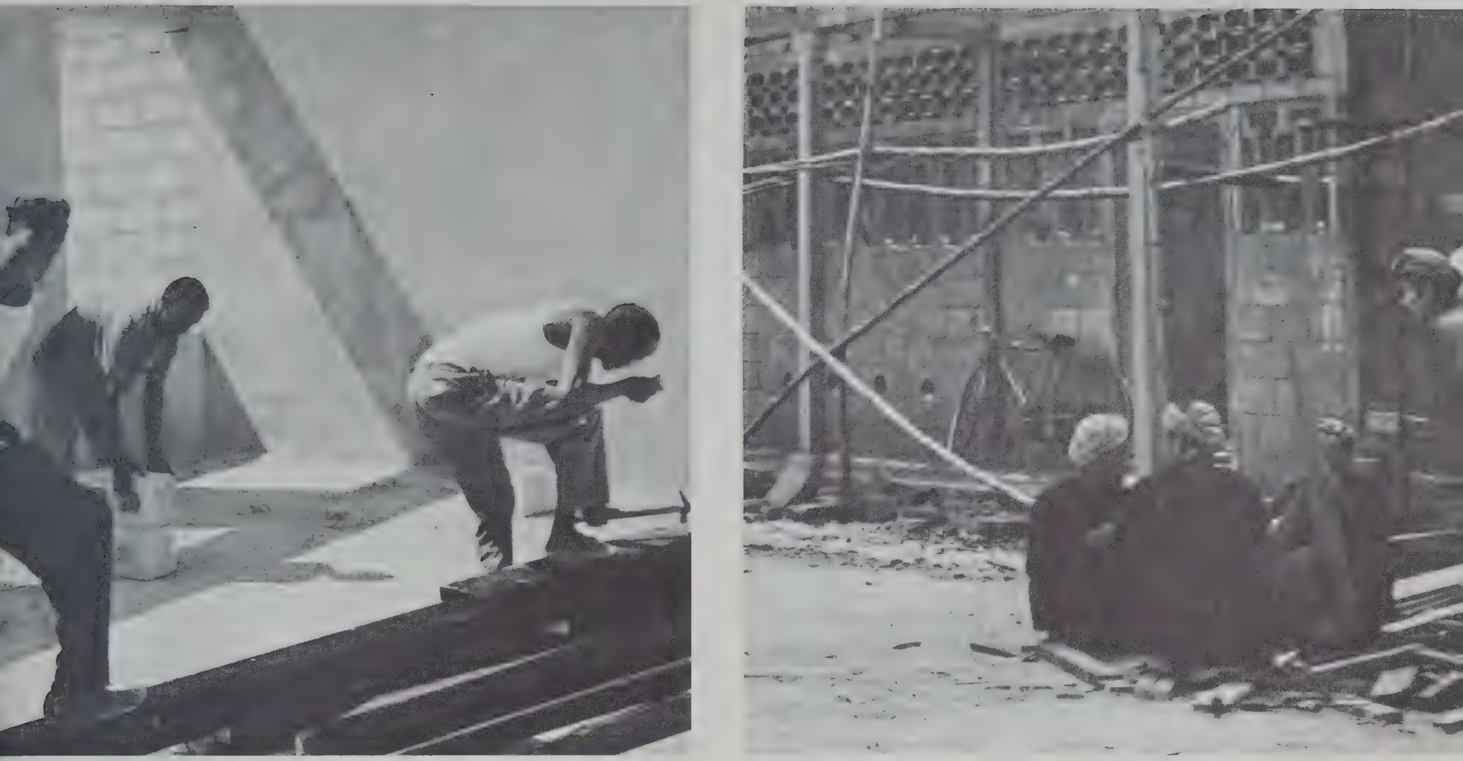

Vietnamese parents see hope for the future in efforts such as construction of this elementary school. Villagers provide the labor and AID, the building materials.

tives, and other private enterprise programs; and housing projects where 25 per cent or more of the mortgage financing is made available from sources within Latin America.

Section 601 provides for the encouragement, development and use of cooperatives, credit unions, and savings and loan associations. Savings and loan associations are required by law in the United States and in most other countries where they have been established, to invest all of their assets (with the exception of certain reserves for liquidity) in residential mortgages.

In appearing before the Committee on Banking and Currency of the House of Representatives in September 1963, we made the following remarks regarding the role of the housing in a development program:

> "Accepting the importance of strongly encouraging investment in the immediately productive sectors, there is nevertheless no question in our minds that a substantial, simultaneous investment in housing is a legitimate and proper part of a development program. Housing demands will rise with income, and the satisfaction of that rising demand is a proper part of the increase in the standard of living that should take place in a developing economy. Furthermore, a substantial part of the savings that will be mobilized by local savings and loan associations—or their equivalent—would not arise in any other way. To put such savings, therefore, into housing is not to divert them from alternative investments. The possibility of home ownership is undoubtedly a strong incentive for consumer savings. Without this incentive, such funds tend to be expended for other consumer uses, rather than saved. U.S. loans and investments to the locally emerging savings and loan institutions stimulate the effective growth of such institutions. In doing so, they both increase the funds immediately available for home loans and foster the habit of saving in the form of home equities."

In view of the limited resources available in relation to the magnitude of the problem, it has been advisable for A.I.D. to continually review what it should undertake in this field and therefore has established the following as general policy:

A.I.D. is prepared to assist developing countries concerned with the rapid growth of urban centers to deal with this problem in as orderly and efficient a manner as possible. Solutions adopted should be those which make the greatest possible contribution to the nation's economic progress, political stability, social order, and equity among its several citizens.

To the extent possible, A.I.D. assistance should be directed to the building of institutions and capabilities, rather than to the building of physical structures.

In giving assistance for the building of institutions, priority will be directed to improvements which have the effect of promoting private activity in urban and regional development as well as those which have the effect of enhancing the authority and efficacy of local government.

Since institutions are built in large measure by training the personnel to man them, priority should be given to training programs established to equip personnel to assess needs, develop policies, plan, devise, administer and enforce: Building and house codes and other land use controls, as well as the regulations governing the acquisition, financing, and transfer of land and real property; land recording and title registration systems; local tax systems, including tax assessing and cadastral surveys; overall metropolitan development plans; and municipal services.

There is a need for broad economic and social analysis of country situations as they pertain to urbanization and housing. A.I.D. is prepared to provide technical assistance for such analysis when resources are not available from the UN, other donor countries, or private foundations.

A typical economic and social analysis will be concerned with the following factors:

What national housing policies, legislation, or agencies are needed?

Are there local or regional institutions competent to train personnel for both private and public activity in the fields of housing, planning, and the administration of utility and other services?

Are local governments equipped to assume responsibility for local planning, regulation of physical development, administration and other services such as environmental sanitation?

Are there financial institutions which assemble savings and channel them into housing and other forms of building activity?

Is there an equitable system of property taxation to permit the provision of essential municipal services?

Do Governmental practices assure fair and equitable treatment in subdivision regulations, zoning controls and building codes?

Is there a basic system of law and practice which will facilitate the transfer and mortgaging of land and buildings?

Is there a building and materials industry composed of experienced entrepreneurs and a trained labor force?

Are plans in existence designed to increase the skills of the work force through on-the-job training in connection with the building and materials industry?

A.I.D. is also prepared to give assistance to countries in the form of financing sector studies, in depth, of urban and housing needs; and is designed to develop priorities and indicate where resources should be concentrated in order to be most effective. Such studies may well indicate that the key essential areas in need of urbanization programs are sites other than capital cities, or even the largest cities. Consideration should be given to undertaking sector studies in areas where A.I.D. activities, such as capital project for developing an industrial park, are creating urban problems.

Metropolitan development plans are logical prerequisites to specific projects for urban improvement whether A.I.D. or otherwise financed. Such projects encompass any and all major physical changes which occur within a metropolitan area (e.g., ports, airports, water and sewage systems, markets, highways). In formulating a metropolitan development plan, urban surveys, studies and data collection must be undertaken. The conclusions and relevant data should be made generally available, so that private persons as well as public officials may be able to adjust their plans accordingly. It is the policy of A.I.D. that such studies should be initiated, in general, before large-scale development projects are undertaken; and, where necessary, some contribution may be made by A.I.D.

A typical metropolitan plan should contain four basic parts:

1. A physical plan to allocate scarce urban land among competing uses, where public or private, so as to achieve complementarity of uses.
2. An economic and financial plan to set the policies which will govern the economic growth of the metropolitan area; and to place the burdens of paying for urban development on the public and private parties who should bear them.
3. A plan, including public health and education, to deal with social problems generated by urban growth and development, such as those involved by squatters and recent immigrants from rural areas.
4. An institutional plan to schedule and make whatever legal and institutional changes may be necessary to carry out the metropolitan plan as well as to allocate responsibility between various agencies of government and to define the role of private and public sections in urban development.

Specific projects for urban improvement, if carried out in accordance with sudden decisions taken in response to the pressure of short-range problems, may be self-defeating or mutually contradictory. Therefore, A.I.D. will normally consider assistance to urban improvement projects if they have been devised, and are to be executed in the context of a sound comprehensive metropolitan development plan, which has been found compatible with the economic development plan and other general policies of the central and regional governments.

Our interest in housing is focused on the problem in many less developed countries of adequate and efficient use of the current level of resources, both public and private, which are spent on housing. There is a need for a better balanced supply of housing to meet more of the needs of middle income and lower income groups. By and large, market mechanisms now serve to supply the requirements of upper and upper-middle income groups. The total deficiency of urban housing in developing countries is on a scale far in excess of the financial resources of A.I.D.

In view of these circumstances, we make grants or loans for urban housing projects only under specific circumstances. An urban housing project should satisfy the metropolitan development criteria outlined above, as well as the general thrust of the following conditions (not necessarily each and every one) in order to qualify for any form of assistance, including technical assistance and local currency financing:

(a) If it has an important demonstration effect, either for the private construction industry or allied industries, and especially if the effect is relevant to the circumstances of many other places.

(b) If it provides housing for low income families.

(c) If, in communities where many members of the lowest income groups live as squatters, it provides for the reorganization of existing sites for the rehousing of squatters or the official designation of areas in which squatters can acquire ownership in programs of urban homesteading.

(d) If it is financed in such a manner as to marshal private resources, whether domestic or foreign, or when such investment will attract increased savings. (Although there should be continued emphasis upon the marshaling of private resources, both foreign and local, for housing programs, assistance to publicly-financed housing should not be precluded.)

(e) If it has unusually important effects in training entrepreneurs, managers, or skilled or semiskilled laborers in the construction and allied industries; or in stimulating the growth of private industries which supply materials or services to the construction industries; or in stimulating the development of domestic financial institutions—especially those (such as savings and loan associations) which specialize in housing.

(f) If it is a project to be financed and constructed substantially by self-help methods or cooperative efforts.

(g) Where direct construction is financed, it should be of such a nature that it can be repeated without recourse to additional foreign aid funds.

Dollar loans for housing should normally cover only seed capital and technical assistance needs of intermediate credit institutions, trade unions, cooperatives or similar agencies which marshal local capital for investment in housing; direct foreign exchange costs of low-cost housing programs or projects, whether privately or publicly financed, and related technical assistance costs associated with improving supervisory practices, construction techniques, etc.; direct foreign exchange costs and related technical assistance costs of industries which produce building materials or supplies, or construction industries. Such loans should be subject to normal development lending criteria. Only in exceptional cases should dollar loans be used to finance directly the local costs of housing construction projects (e.g., where such loans are required for overriding social or political reasons, such as the amelioration of slum conditions which play a critical role in political unrest).

Local currency loans may be used to finance local costs of housing construction as well as capitalization of credit institutions and building industries.

It is A.I.D.'s policy to exercise the same degree of monitoring of dollar financed urban construction projects as exercised by U.S. domestic agencies, such as FHA, URA, PHA, and BPR, in connection with urban construction projects in the U.S. Local currency financed urban construction projects will not usually receive the same degree of monitoring, but supervision will take into consideration the availability of personnel, the importance and significance of the project, the degree of U.S. identification, etc.

A.I.D. will review and approve the supervision criteria established by intermediate institutions, such as savings and loan associations and housing agencies receiving financial assistance from A.I.D. for urban construction projects, and make periodic spot checks to see that such criteria are being observed.

Our major area of activity in housing and urban development is a part of the Alliance for Progress in Latin America. A most significant factor in this area has been the success of the private savings and loan associations in Latin America which have been assisted by technical assistance from U.S. savings and loan executives and "seed capital" loans from A.I.D. During the last three Fiscal Years A.I.D. loans for housing have totaled almost $115 million and those made by the Inter-American Development Bank have totaled slightly more than that.

A significant new development is the Housing Investment Guarantee Program, under which A.I.D. guarantees private U.S. investors in financing housing in Latin America. $12,200,000 of these were made during the Fiscal Year ending June 30, 1964, and $58,800,000 in the following Fiscal Year ending June 30, 1965.

We are now endeavoring to channel investment guarantees into low-cost housing and to strengthen institutions, such as cooperatives, savings and loan associations, and labor unions, which can carry on a mortgage financing function on a permanent basis. ☐

A.I.D.'s Loan Program in Latin America

by

Harold Robinson

In the past, two common misconceptions have helped deter adequate investment in housing housing in Latin America: 1) that housing is important for social reasons only and has no economic significance; and 2) that Latin Americans have no capacity to save so, all housing must be government financed or financed from external sources. (Now, of course, the balance of payments deficit is a major deterrent.) Nothing could be farther from the truth. A home construction industry is an integral and essential part of economic development. Housing is definitely an adjunct of industrial and agricultural development in the developing as well as developed countries. On the one hand, it is social overhead or infrastructure that has as great an importance to economic development as roads for markets or power for industry. One the other hand, housing is itself an industry. That Latin Americans can and will save is evidenced by the phenomenal growth of the A.I.D., the inspired savings and loan industry, and the ability to meet monthly debt service on home mortgages.

Nevertheless, it is still not uncommon to hear the statement that housing should occupy a low priority in the economic development of the developing countries, despite the fact that in Latin America alone the housing deficit is somewhere between 15-20 million units, with an annual increase in the deficit of 1 million homes.

The rationale for a low priority is, of course, that industrial and agricultural development must precede rises in the standard of living and availability of consumer goods. This is further predicated upon the need for foreign exchange generating commodities, and income producing capital investment, as against satisfying immediate social and physical needs and wants. Yet, it is evident that, aside from humanitarian reasons, housing must be provided in new and expanding economies to complement and make possible industrial and agricultural development; and that, in the more advanced underdeveloped countries, at least, home construction industries can themselves make a direct contribution to full employment and to the national economy. Moreover, certain conclusions are incontrovertible: Economic assistance must, because of social and political pressures, include housing, and must be given full and serious consideration; population increases and shifts will automatically necessitate the diversion of some capital to the construction of housing; humanitarian considerations cannot be totally disregarded; and housing is one of the best means of showing visually and dramatically to the peoples of the underdeveloped countries a concern with their social and physical plight.

A most striking feature of Latin American growth, moreover, is the rapid trend toward urbanization. The rate of urbanization in Latin America is the highest of any underdeveloped region in the world. If the social and economic problems of Latin America are to be dealt with realistically, urgent consideration must be given to the need of the cities over and above housing, and strenuous efforts must be made to meet these needs.

The haphazard growth of the urban centers is due in large measure to a failure by national and local governments to coordinate decisions with each other or with those of private interests. This failure to correlate urban physical development with regional development and with national economic planning means that decisions as to allocation of resources are not made at a national level, or decisions are often made independently of each other. The result is a lack of a clean-cut development policy, a waste of private and public investment, and uncontrolled urban growth which prevents the realization of the economic and social goals embodied in the Charter of Punta del Este.

Recognition of the Problem

Virtually all the developing countries of the world have taken cognizance of the housing problem, and regard it as of paramount importance. In

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Latin America, every country has some form of housing program and a national housing agency or agencies to which either budgetary support or external capital has been made available.

The U.S. Congress and A.I.D. have also recognized the importance of housing to economic and social development. In appearing before a Congressional Committee, for example, the then A.I.D. Administrator said:

> "Accepting the importance of strongly encouraging investment in the immediately productive sectors, there is nevertheless no question in our minds that a substantial, simultaneous investment in housing is a legitimate and proper part of a development program. Housing demands will rise with income, and the satisfaction of that rising demand is a proper part of the increase in the standard of living that should take place in a developing economy."

Legislative guidance for A.I.D.'s housing and urban development activities is provided in Sections 102, 207, 221, 224, and 601, of the Foreign Assistance Act of 1961, as amended. Under "Statement of Policy" in Section 102, Congress has added "home ownership and decent housing" to the assistance categories of agriculture, education, and health. Section 207 includes "to clear slums," "cooperatives," and "urban development" within the subjects of capital assistance. Section 221 gives a special preference to investment guaranties for housing projects over and above the usual 75% limitation covering other types of all risk investment guaranties. Section 224 authorizes a total of $500 million for housing projects in Latin America. Section 601 provides for the encouragement, development and use of cooperatives, credit unions, and savings and loan associations.

Throughout the Charter of Punta del Este there are references to the need and desire for decreasing the housing deficit in Latin America, and for ameliorating the housing conditions under which so many of the people of Latin America now live. One of the specific goals of Punta del Este is:

> "To carry out urban and rural housing programs to provide decent homes for all our people."

In furtherance of this objective, the Latin American countries collectively agreed to:

> "Increase the construction of low-cost houses for low-income families in order to replace inadequate and deficient housing and to reduce housing shortages; and to provide necessary public services to both urban and rural centers of population."

The Social Progress Trust Fund implemented this goal by providing U.S. funds in the amount of $525 million, part of which was to be used for:

> "Housing for low-income groups, through assistance to self-help housing and to institutions providing long-term housing finance and engaged in mobilizing domestic resources for this purpose."

In all, the U.S. Government has, since 1961, committed over one billion dollars for housing in Latin America.

Accomplishments

Two agencies have been providing financial assistance for housing and urban development in Latin America. The Inter-American Development Bank, with funds allotted under the Social Progress Trust Fund and Fund for Special Operations, has already committed $287 million in loans for housing. A.I.D. has loaned $161 million to date, and has loaned, granted or authorized the release of approximately $50 million worth of local currency. In addition, A.I.D. has a program totaling $500 million of authorizations of guaranties of U.S. capital invested in Latin America.

Through the combination of A.I.D.-IDB every country in Latin America has participated in this loan assistance. Inasmuch as loans are matched to a considerable degree by host-country contributions and inputs, and by down payments, this means that over a billion and a half dollars will be invested in housing through the present program alone.

In general, IDB's loans have been made to national housing agencies for the construction of housing for sale to low-income groups which can afford to pay for housing, given reasonable mortgage terms. The emphasis has been on aided self-help techniques and cooperatives. It cannot be expected, however, that U.S. resources alone will solve Latin America's housing problem. Because of the enormous requirements, the problem is one which basically must be solved by the Latin Americans themselves. A.I.D., therefore, has placed its greatest concentration on helping the governments and peoples of Latin America create intermediate credit institutions and cooperatives whose sole function is the accumulation of savings of the many, and the channelling of those savings into housing. These are permanent institutions which will mobilize and marshal local resources on a continuing and increasing basis. Our financial assistance is "seed" capital, which, properly nurtured, will increase the economic and social wellbeing of Latin America.

Through A.I.D.'s initiative, savings and loan associations patterned after those of the U.S. are already operating in Bolivia, Chile, Dominican Republic, Ecuador, El Salvador, Nicaragua, Panama, Peru, and Venezuela. Guatemala has a system operating under general banking laws, and Brazil's omnibus program provides for similar institutions. Exclusive of Brazil and Guatemala, there are now in some savings and loan associations, over 560,000 savers, some $170 million in net savings, and over 66,000 mortgage loans totaling $350 million. In this effort we have enlisted the technical competence of the U.S. savings and loan industry, and hope to use our investment guarantee authority to an increasing degree.

Another form of institution that is slowly growing in importance and acceptability is the housing cooperative. Through the contractual technical assistance of the Foundation for Cooperative Housing, federations of housing cooperatives have either been created or strengthened in such countries as Bolivia, Chile, Colombia, Honduras, Nicaragua, Panama, and Peru, and actual physical projects are or will shortly be underway in Argentina, Brazil, Colombia, Honduras, Nicaragua, and Panama. Emphasis is being given to the advantages of the single or blanket cooperative mortgage.

In addition, A.I.D. has been providing a variety of forms of technical assistance designed to create or improve institutional framework or to meet certain specific problems. For example, one of the needs of both public and private authorities is current information on the present and projected investment in construction of money, labor, and materials. Without such information, it is impossible to program or schedule investments. A.I.D. has been assisting in the establishment of national systems to compile, evaluate, and disseminate such information. In order to determine effective demand in individual urban centers, A.I.D. has developed a manual for the making of market analyses which can be utilized by persons with limited economic background. To improve the knowledge and calibre of personnel within the savings and loan systems, the American Savings and Loan Institute, with A.I.D. funds, is now engaged in developing a five-fold program of translation, correspondence course, local study groups, and U.S. training. To assist local governments control of haphazard growth of their communities, to coordinated local governmental decisions with each other and with those of private interests, and to correlate urban physical development with regional development, and national economic planning, A.I.D. has developed guidelines and an approach to urban development, and is supplementing these guidelines with grants and loans for the formulation of actual physical, economic, and social plans.

Tasks Ahead

While the magnitude of financial assistance is considerable, it is still totally inadequate in terms of the total need. Housing construction is falling behind family formation. A considerable amount of success has been achieved with A.I.D. technical assistance in the creation of institutions in the private sector, but these still need additional inputs of financial help and a continuance of varying kinds of technical counsel and advice. A.I.D.'s technical assistance to the public sector has been extremely limited.

Experience has shown that technical assistance without financial help proves wholly inadequate, and that, concomitantly, financial help without technical guidance is often improperly used. In the private sector, we must build upon the successful savings and loan system, create similar systems in those countries where they do not now exist, and call more heavily on the U.S. Savings and Loan League and National Association of Insured Savings Associations. To complement these home credit institutions, both technical and financial assistance is needed in the development of internal forms of secondary markets and secondary market facilities. In this regard, use has been made of the Mortgage Bankers Association of America, the Federal National Mortgage Association, and the Federal Home Loan Bank Board. The whole concept and field of housing cooperatives need increasing support in order to achieve economies in construction and management, to provide domestic control and maintenance, and to install a sense of responsibility in the recipients of housing aid. The idea of urban development and housing as only one element of urban development must be promoted and assured. Local planning bodies must be strengthened, and their functions defined and enlarged. Technical assistance is necessary to assure proper physical, economic, and social urban planning so that the metropolitan areas may develop logically and systematically. In the public sector, an attack must be made upon the growing squatter settlements which comprise so much of the urban population. There must be an acceptance of lower construction, space and amenity standards which will permit varying approaches to squatter settlement eradication, such as land and utility programs, core housing designed for expansion, and further uses of aided self-help. Technical assistance must also be provided the national public housing institutes so that they may address themselves to the lower income groups for which they were originally established, and to assure proper management, which, in turn, will result in decreasing payment delinquencies and in better maintenance. National housing policy must be developed within the framework of national economic plans so that housing is given its proper priority in economic, social, and political development.

In terms of a home construction industry, Latin America is in the position of the U.S. 30 years ago. Only recently, in large measure due to U.S. aid and in part to the influx of population to the cities, has Latin America experienced large-scale housing projects with the concomitant problems of site planning, long-term financing, off-site and on-site fabrication and organization, and the concept of reserves for repairs, maintenance and replacements. These concepts were new to our own home construction industry before the advent of the PHA and FHA. The U.S. home construction industry now has the experience and know-how to assist the Latin American industry. □

A.I.D.'s Role in Africa

by

George Hazel

During the past year the Africa Bureau of A.I.D. has received many proposals from such diversified groups as consulting firms, trade associations, and universities, each offering their services and ideas to meet the pressing housing needs of the developing countries in Africa. Many of these proposals are sound and would be given serious consideration under normal circumstances; others, such as the proposal to do a feasibility study on low-cost housing in Africa, would not be considered under any circumstances. We, in the Africa Bureau, feel that if you look closely through the archives of the U.N., the International Office of HUD, and A.I.D., you will find an ample supply of reports on low-cost housing, but few statistics on successful low-cost housing projects. However, it is obvious to A.I.D. that a low-cost housing project is feasible nearly any place in the world if there is an adequate infrastructure.

The other housing proposals that A.I.D. received and rejected or deferred were casualities of the times. Today, the United States is confronted with internal problems (the Viet Nam War, a serious balance of payments situation, and a gold outflow) that have caused a complete review of all Government programs. Our Foreign Assistance Program, which represents only a small percentage of our GNP and an equally small percentage of the Government's fiscal budget, has had to be reduced substantially during the past few years. A.I.D., in turn, has been compelled to prune many worthwhile programs. Working within the framework of the reduced budget for A.I.D., the Africa Bureau has had to re-evaluate its programs, concentrating its efforts on regional projects in lieu of its former bi-lateral program. Generally speaking, it would be difficult to qualify most housing programs as regional projects under A.I.D.'s definition of this term. It has also been a truism for many years that housing does not enjoy a very high priority within A.I.D., which has directed most of its resources toward agriculture, health and education, family planning, industrial development, etc.

Within the framework of A.I.D.'s regional policy program for Africa, the limited capital resources, and the low priority that housing carries, what can A.I.D. do in housing for a continent that is larger than India, the U.S., China, and one-third of Russia combined? What can A.I.D. do for a continent that has over 275 million people and 39 countries, wherein most of the countries are less than 10 years old? Certainly, these newly emerging nations, which often have a single commodity economy and have, in some cases, as high as 80% of their population working in agriculture, cannot provide the capital to finance the housing needs of their people. Nor can the U.S. Government, which has not been able to provide adequate housing for everyone in its own country, do more than provide demonstration programs in housing.

Housing Africa

Before giving an insight into what A.I.D. hopes to do in housing in Africa, let us review what A.I.D. has done in the past, and what it is doing today in housing in Africa. In the past, A.I.D. did a number of housing studies, provided substantial technical advice in certain countries, helped develop a few mortgage type financial institutions, and financed a number of research projects. One of the more imaginative research projects was done on the structural potential of foam plastics for housing in underdeveloped countries. The A.I.D. housing teams in Nigeria (composed of A.I.D. and HUD technicians) were particularly successful, and were directly responsible for setting up a successful savings and loan operation in Eastern Nigeria, although A.I.D. did not provide any capital for the association. Unfortunately, the recent civil war in Nigeria has cast doubts on whether this financial institution is still operating. A.I.D. also helped form a savings and loan association in Ethiopia by providing tech-

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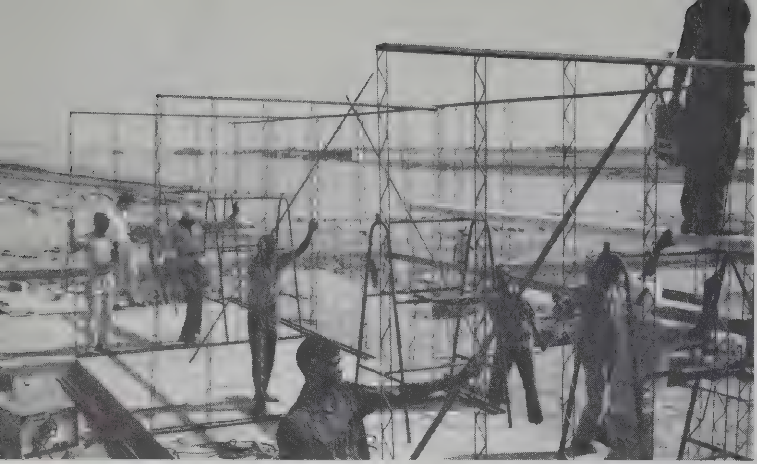
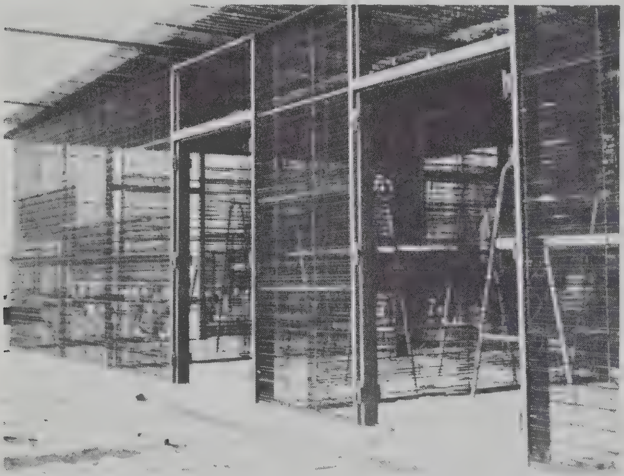


First attempt by U.S. builder to use a steel framing system—exterior and tine interior walls—Dakar, Senegal.



Assembly of steel framing panels in process.

nical services and a small grant. This association has been relatively successful and has enjoyed a moderate growth.

Our current housing effort in Africa is limited to a small technical assistance project on the Ivory Coast and to a housing guaranty program. The Ivory Coast housing advisor, who is a representative from the International Division of HUD, has done an outstanding job in directing the low-cost rural housing program which is scheduled for completion at the end of the year. Upon completion of this program, A.I.D. will have returned its last housing advisor from Africa. As the need arises in the future, the Africa Bureau of A.I.D. will look to the private enterprise sector of our country and the International Division of HUD for any needed housing technicians.

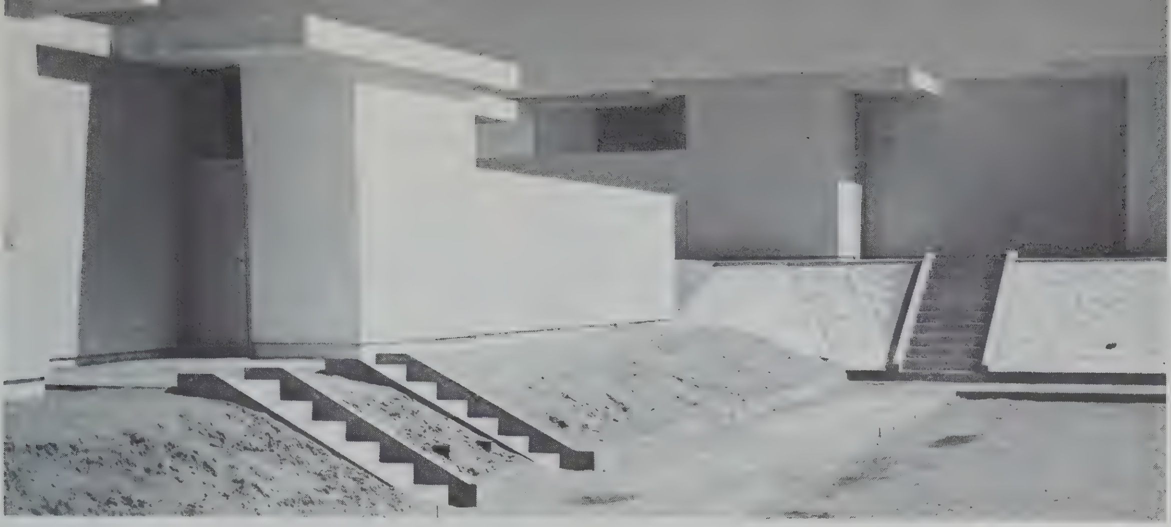
The main thrust of our current housing effort in Africa is the housing guaranty program. Under the Foreign Assistance Act of 1961, as amended, Congress authorized A.I.D. to guaranty investments in housing guaranty projects in areas outside of Latin America up to $160 million; but the Balance of Payments Committee has restricted the use of this guaranty authority by A.I.D. to $50 million. Of this amount, $35 million has been allocated to the Africa Bureau. The road to implementing the housing guaranty program has been long and cumbersome, and covered with many pitfalls. A number of projects have been cancelled due to political unrest. Others failed because the host government lost its interest in the project. In another case, the host government and the builder had trouble reaching an agreement on problems that arose after contracts were signed.

There have been successes in the housing guaranty program in Africa. At the present time we have two projects under construction, a third scheduled to start in Senegal within the next few weeks, and a fourth project, with a signed contract, that can go ahead if the builder and host government can resolve their current problems.

Future Goals

So much for A.I.D.'s past and present programs in housing in Africa. More importantly, what are the future goals of the Africa Bureau in meeting the pressing housing needs of the African continent? For the reasons set forth previously, the Africa Bureau of A.I.D. plans to look more and more to the private enterprise sector in the U.S. to assist A.I.D. in carrying out its future housing program in Africa. Private enterprise, using the housing guaranty program with modifications, can be a useful vehicle for transporting U.S. technical knowhow. However, past history of the housing guaranty program has shown that many projects fall far short of demonstrating technical improvements. Many only demonstrate the fact that with long-term financing it is possible to build and sell houses in a foreign country. This is certainly not true of all builders in this program. There are those who are interested in more than just the P & L statement, and who make a determined effort to inject fresh ideas in a project.

Projection of first plaster coat with mortar spray mach.



Finished housing in Dakar, Senegal.

Our most recent project in Africa is an example of a builder who looked beyond the financial statement by introducing underground wiring, cluster housing, irrigation of open spaces, and fabricated steel framing. Irrigation of open spaces will provide a greenbelt in a sub-division for the first time. A.I.D., in conjunction with this same builder, has worked out a legal innovation whereby A.I.D. has agreed to use the lease-sale type contract in lieu of the mortgage and deed, which is so common in the United States. Although this means that the title to the property is not transferred until the debt is paid, A.I.D. has adjusted the contracts to provide for the purchaser's equity to build up at a rate identical to that under an amortized mortgage, and provided the buyer freedom to sell his interest in the property without restriction or obligation. This is a substantial change from the procedure used at the present time in that country.

The housing guaranty program, which is supported in the congressional branch of our Government, is not so popular in some sections of the executive branch. The agency which is the watchdog of our balance of payments looks upon the housing guaranty program as a serious drain on our dollar reserves, and is quick to point out that the American builder often fails to demonstrate any technical improvements in housing construction methods or procedures. Actually, the dollar outflow is merely a short-term negative effect, whereas, the program has a very favorable long-term advantage resulting a hard currency in-flow of two to three times the original loan.

The Africa Bureau recognizes the dollar out-flow problem, and also recognizes that the housing guaranty program by itself can only have a limited impact in meeting the housing needs of Africa. Therefore, we propose to direct our efforts toward developing savings and loan or mortgage type financial institutions that would mobilize local capital to complement and eventually replace foreign capital as a source for construction financing. At the present time there is an amendment in the omnibus housing bill that would authorize U.S. savings and loan associations to make housing loans under the housing guaranty program in areas outside of Latin America. Basically, this will merely provide for an additional source of funds for any future housing guaranty program in Africa. However, there is another proposed bill that is supported by the savings and loan industry that would authorize savings and loan associations to make equity investments in savings and loans in Africa. We favor the stock-type savings and loan association because we feel that we can attract capital in the form of equity and loans from the parent organization, and from experienced management, which is so often lacking in a mutual-type association staffed with indigenous personnel.

To encourage the participation of U.S. financed institutions, we look to our investment survey program as a vehicle to assist the U.S. investor. Under this program, A.I.D. could consider covering up to 50% of the expenses incurred by a qualified U.S. investor who, after exploring the possibility of setting up a savings and loan association in Africa, decides not to invest. However, if the company or individual decides to go ahead with the investment, then A.I.D. does not pay any of the expenses incurred by the U.S. investor. A.I.D. could also consider channeling available local currency funds into a newly formed savings and loan association or a mortgage bank. If the balance of payments crisis improves substantially within the next year, we could possibly look to the housing guaranty program as a source of additional seed capital.

By proposing to direct our future efforts toward creating savings and loan associations or mortgage banks, we do not mean that we are going to do away with pilot housing projects. But we do visualize a future program that would unite the U.S. financial institutions that provide equity and management, and the U.S. builder who desires to build pilot demonstration projects. □

The Role of the F.H.A. International Division

by

William N. Womelsdorf

The role of the FHA International Division in housing the developing nations is undergoing continual analysis in the light of world conditions, adjustments in foreign policies, the money market, and balance of payment problems. After almost four years of experience, during which a large number of project applications from the Latin American, African, and East Asian Bureaus of the Agency for International Development were received and processed, we still find the program in the infant stage, hopefully capable of surviving the stress and strain of a rapidly changing world, and requiring constant attention to the major and minor defects inherent in the development of a new program.

Simply stated, the role of the International Division is to minimize, to the extent possible, the risk to the United States Government against losses which may occur in guaranteeing U.S. private investment in housing for the developing nations. This role evolves into two separate functions: first, to provide security for those cases in which AID assumes the full contingent liability risk; and, second, to monitor those cases in which the host-country government guarantees the repayment of the private U.S. dollar loan and/or a host-country agency insures individual mortgages in local currency.

For this purpose, The International Division was brought into existence in the fall of 1963 in response to AID's request for underwriting services. The basic agreements between AID and the Department of Housing and Urban Development, which we refer to as the Bell-Weaver agreements, determined the basic character of our working relationship with Bureaus at AID. The operating principles define those functions to be retained by AID and those to be assumed by the Department, and establishes the basic criteria for handling cases. These agreements are now being reappraised on the basis of our experiences to date.

AID retains the responsibility for foreign policy considerations and relations with host-country governments; for the negotiations of country to country agreements; for country allocations of authority and the establishment of priorities; for problems relating to monetary exchange; for final approval of basic programs, underwriting policies, and individual standards; for final approval of individual cases; and for inspection during construction.

The Department agreed to make its full resources available for the successful execution of the program, including the development of an underwriting system. The Federal Housing Administration was given the responsibilities of processing individual applications and of developing a sound underwriting system suitable to the letter and spirit of the Foreign Assistance Act, as amended from time to time by Congress, and in conformity with the policies of the individual Bureaus.

Functions

Specifically, the agreements included the functions to be carried out by the International Division and AID as follows: (1) The International Division receives and reviews applications sent by AID, performing all necessary underwriting processing functions, and is subject to all policies, allocations, and priorities established by AID. (2) Upon the International Division's finding of feasibility of a project, AID determines the feasibility of furthering processing and issues a Letter of Advice or reservation necessary to cover the amount of guaranty requested if approved. Approval or disapproval of all projects rests solely with AID.

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Typical housing in rural Central America.

The International Division then carries out the technical review of site development and building construction drawings, specifications, quantity survey-cost estimates, and other documentation deemed necessary to assure continued maintenance of housing, thus providing the security to the long-term investment.

For our purposes we have divided the stages of processing into the pre-application stage, the application stage, the feasibility stage, and the intensive and final review stages. FHA's underwriting services vary only slightly with each Bureau, and represent well-defined areas in the overall processing of an application.

Certain phases in the overall processing are necessarily performed by AID, by country missions, host-country guarantors or mortgage insurers, and by other contractors retained by AID to carry out certain procedures, particularly with respect to inspection during construction, local administration and servicing of mortgages held in security for the long-term investment, and management deemed necessary to assure the maintenance of the housing during the period of amortization. There is, therefore, no direct correlation or basis for comparison with FHA's domestic underwriting procedures which provide for all such services.

During the pre-application period, in which a project is developing in embryonic form, the potential sponsor relies on the advice and guidance provided by host-country mission personnel, AID Washington Bureau personnel, and the International Division. This stage is normally time conditioned (i.e., the open season for filing an application is limited).

The rapidity with which a potential sponsor can make preliminary arrangements for construction financing and the long-term take out, secure a suitable site, develop preliminary architectural and engineering exhibits, obtain clearances from local housing and planning authorities, receive assurances that an acceptable local administrator is available, confirm the availability of a host-country guaranty, if applicable, accumulate the necessary market information, and select an appropriate building and sales program needed for filing an acceptable application, is a critical factor.

The sponsor is hard pressed to gather all of the required exhibits and documents which will secure his position prior to the submission of a formal application. This frequently results in the submission of incomplete and inadequate applications. This is not a program for amateurs, but one which requires the best professional, legal, technical, and organizational skills.

The formal applications are submitted directly to the African and Far East Bureaus in Washington. Applications submitted to the Latin America Bureau are sent through the host-country missions. Applications from Africa and the Far East are normally forwarded to the International Division for a pre-feasibility analysis to determine the completeness and adequacies of the applications received.

These applications are prepared in a narrative form in accordance with a format provided by the International Division. Applications received from Latin America are reviewed for completeness by the mission and submitted to Washington with their field recommendations. The International Division receives applications only after AID has determined that the project complies with country objectives and that an allocation of authority is available.

After an application is received, the International Division begins the work of analyzing the application, exhibits, and documentation submitted, in preparation for a visit to the country for the purpose of making a feasibility determination.

Project Criteria

The basic criteria in determining the feasibility of a project are the assurances that: the sponsorship is capable financially and technically to successfully carry out and complete a project; the site and its location are suitable for the purposes intended; the building and sales program proposed will be appropriate to the income group to which it is directed, and is in compliance with local housing and planning objectives; site development and building construction costs are reasonable and competitive with comparable local housing; a market exists for the number and types of dwelling units at the sales prices proposed; the number of units proposed can be absorbed by the market within a reasonable period of time.

If the applicant meets these criteria to a reasonable degree, the project is considered to be feasible. We then recommend to AID that further consideration be given to the application. Failure to meet any one of the foregoing conditions to a reasonable degree will result in a recommendation for the rejection of an application.

Our first concern is with the capability of the sponsorship. It must be borne in mind that the sponsor has the first exposure to risk. His investment in developing an application, in travel, and in other expenses can be quite sizeable before he is in a position to file a meaningful application.

We want to be sure, therefore, that the sponsorship has the capability of financing the application package, can secure construction financing, and has reasonable assurance of obtaining the long-term financing for the take out; and further, that he can provide the legal, technical, and managerial skills required to develop the required documentation, drawings and specifications, quantity-survey cost estimates, and an appropriate sales and marketing program, in a satisfactory manner, as well as an ability to provide the necessary supervisory and managerial skills to carry out the building program with assurances for the continued maintenance of the project upon completion. His credentials are carefully checked during the feasibility analysis of the project.

Our field examiners visit the site, investigate its technical qualities, and appraise its location and the availability of community facilities, such as: transportation to and from work, schools, hospitals, police, fire protection, and shopping facilities. The site is also evaluated in terms of a deteriorating or improving neighborhood and competing housing.

An assessment is made in the field with respect to the building program and its suitability to the site and location. Our examiners also obtain typical development costs from local sources. Statistical information concerning housing demand is also gathered to determine the probable marketability of the project and the anticipated rate of absorption.

Our findings and recommendations are forwarded to AID for their considerations. This phase of our operation normally takes from six to twelve weeks depending on the number of cases involved in a country.

To carry out these investigations, the International Division is organized into three sections: the Financial, Technical, and Evaluation Sections. The basic responsibility of the Financial Section is to investigate the financial capability of the sponsorship during this phase of our operations. The Technical Section has the responsibility of reviewing preliminary site development and architectural plans, outline specifications, and has the responsibility of determining the acceptability of the site location and the building and sales program, and of determining the probable market and rate of absorption of the proposed project.

Under normal conditions, a two-man team—one from the Technical Section and one from the Evaluation Section—will perform the required field investigations. In those countries where we have not had a recent market study, a market analyst accompanies the team.

On the completion of our feasibility determinations and recommendations to AID, further action will depend on AID. Upon AID's acceptance of our recommendations for a feasible project, a Letter of Advice from AID to the sponsor or U.S. investor is our signal that the project is again active.

In those cases in which AID assumes the full risk, we can anticipate meeting with the sponsor and his technical staff to discuss our findings and to provide him with guidance in the preparation of exhibits which will be required prior to a final commitment to guaranty. The sponsor, however, is required to provide AID with firm commitments for the construction and long-term financing from acceptable lending or banking institutions, which must be secured prior to our initial conference with the sponsor and his technical staff. This stage of project development depends entirely on the ability of the sponsor to secure himself, with respect to the short and long term financing, prior to committing additional expense in the development of the architectural and engineering exhibits and legal documentation which will be ultimately required.

The purpose of the initial conference is to share with the sponsor and his technical staff the product of our accumulated experience in the field and to review the preliminary drawings and specifications in the light of our studies. At this conference, we provide the sponsor with our comments concerning the overall aspects of the project, determine those additional exhibits that will be required for the intensive review, and establish a time schedule for the submission of all documentation.

For our purposes, the sponsor should develop the drawings and specifications in a substantially final form, complete enough to enable an accurate quantity survey cost estimate. In addition, subsidiary agreements and exhibits pertaining to home owners associations, condominiums, cooperatives, or community maintenance agreements should be provided in draft form. The package should be complete when submitted, since a comprehensive and meaningful review cannot be made if any of the required documentation or exhibits are missing.

The time consumed between our initial conference with the sponsor and the presentation of the intensive review exhibits and documentation, which we refer to as the project development shop, and documentation is usually protracted and fraught with possibilities that a project may collapse due to the loss, perhaps, of a small element essential for the continued feasibility of a project. The sponsor's exposure to loss becomes greater with each delay. It is our objective to minimize delays to the greatest extent possible. Incomplete and inadequate exhibits submitted prematurely inevitably lead to time consuming delays.

Monitoring Procedures

Procedures for monitoring cases which carry the full faith and credit of the host-country government for the repayment of the U.S. dollar loan, or those cases in which the individual mortgages are insurable by local agencies, have not been fully developed. It is anticipated that the basic underwriting processing will be undertaken by a local housing agency designated by the host-country government, and that a direct relationship between the host-country underwriting agency and the sponsor will be established.

Through our monitoring service we will be able to share with the country mission and the local underwriter's technical staff our findings and recommendations in the field prior to the initial development conference with the sponsor. Based on our mutual understanding of the requirements for further processing, the local underwriter will carry out the initial development conference with the sponsor. The country mission and FHA will provide representation as deemed necessary or desirable. A copy of the completed package required for intensive review will be forwarded to the International Division for review and comment.

To the extent possible, this review will be carried out concurrently with that of the local underwriter, and our findings and recommendations will be forwarded to the country mission. If necessary, we will again meet with the country mission and local underwriters to review our findings and reach an understanding of requirements for modifications and clarifications needed prior to a final commitment by the host-country guarantor or insurer and AID.

The need for this joint conference will depend largely on the capability of mission personnel, and of local underwriters in evaluating and collating conflicting recommendations should any arise. Approval of our collective findings and recommendations is, of course, subect to final decisions by AID and the host-country guarantor. The final review of all exhibits and documents for conformity by the sponsor will be carried out by the local underwriter, with recommendations for approval submitted to AID and the host-country guarantor.

Our experience in this role, thus far, has been limited. The results however, are most encouraging. We believe this approach to be sound and businesslike in that it provides host-country guarantors and insurers assurances that their risks are minimized and that their interests are reasonably protected.

We believe that our joint participation with host-country underwriters should ultimately yield substantial time-saving benefits to sponsors. We also foresee an increased understanding of our mutual interests with host-country underwriters and those of the sponsor-builder in carrying out privately financed housing projects.

Industry Participation

It can be seen from the foregoing that our relations are primarily either with the sponsor-builders and their technical staff or with the country mission and the host-country underwriter's staff. We are, however, often contacted by fabricators and suppliers seeking approval for innovations in building elements and materials of construction.

It is a policy of the Federal Housing Administration to encourage possible new forms and methods of building construction which will lead to better and more economical housing. The International Division, however, is not staffed to undertake the research required to validate the acceptability of new materials or methods of construction. To meet this need, we rely on our Technical Standards Division which makes determinations of this nature.

It should also be noted that the sponsor-builder is the prime mover in carrying out a successful housing undertaking. The responsibility for the incorporation of innovations in planning, architectural designs, marketing and management rest with him. Planning and construction innovations must meet local building codes and zoning ordinances.

U.S. manufacturers and suppliers who find it desirable to participate in this program should be prepared to assume a financial risk in proving out the acceptability of their products in the local market.

There are, however, great possibilities for U.S. fabricators and suppliers to collaborate with host-country manufacturers in the development of suitable building elements which can be produced locally, and which are appropriate to local conditions and acceptable to the market to which the housing is directed. There are also possibilities of establishing a closer relationship between U.S. public and private housing research agencies and similar institutions in the developing countries, particularly in the areas of market research and management.

Market Conditions

In our field of investigations, we are constantly seeking information which will re-enforce our findings with respect to local market conditions. In the developing countries the demand for housing is so great as to be overwhelming. The selection of a market becomes an extremely difficult one, both from the social and economic aspects. AID's objective is to reach as far down into the market as economically feasible.

It is obvious, however, that privately financed housing, which carries relatively high interest rates, cannot compete successfully with subsidized housing. The selection of a market area and family income groups capable of meeting the long-term financial obligations is a critical one.

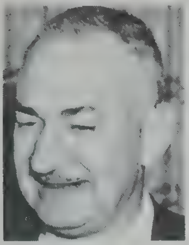
Existing managerial skills are provided principally by government housing agencies, and are oriented to their special requirements. Management skills thus developed are poorly suited to carrying out privately-financed housing programs.

To say that the housing investment guaranty program has few problems would be the understatement of the year. We find that one of the greatest problems is the lack of communication and of understanding of the program and its objectives. Potential sponsor-builders, host-country financial and housing agencies, investors and bankers (all of whom may have financial risk) are more often than not confused and confounded by the complexities of the program.

The packaging of a project is staggering if undertaken by unknowledgeable entrepreneurs. To comply with the complexities involved in securing construction and long-term financing and in providing and paying for the needed legal, managerial, and technical skills is not an easy task. Most of the pitfalls can be avoided if the sponsor-builder follows guidelines established on the basis of our experiences from the initial phases in the development of an application to the accumulation of final exhibits and documents required. It should be remembered that the securing of a guaranty for the long-term investment depends on compliance with all requirements established by AID, host-country guarantors or insurers, and investors. Failure to meet any of the requirements at any stage in the processing causes undue delays and the possible failure of a project, even though considerable time and money has been expended by ourselves and the sponsor.

We are available at all times during the development of a project for consultation and discussion with sponsors and their technical staffs of problem areas which may, and often do, occur. We find, however, that piecemeal submissions cause undue delays in the overall processing. The best advice we can give a sponsor is that he retain knowledgeable legal counsel, competent planners, architects, and engineers, and utilize them to the fullest extent. We cannot carry out a meaningful review until the package is complete.

The beneficiary of what may appear to be a long drawn out process is the home buyer, the one who in the final analysis foots the bill and provides the security for the repayment of the private U.S. loan. We believe that in the performance of our underwriting service we are securing for the home buyer a dwelling unit which will reasonably meet his requirements and will have a higher value than housing to which he now has access. □



The U.S. Architect and Engineer in International Construction

by

Karl O. Kohler, Jr.

The role of the U.S. Architects and Engineers in international construction has been expanding at an accelerated rate during the past six years. This increase in demand for U.S. technical assistance has resulted from both the increased operations of private investors in foreign works and the accelerated operations of the several international financing agencies which are working hemispherically or world-wide in the development of social and economic programs for the lesser developed countries.

The United States agencies that are engaged in foreign assistance programs are the Export-Import Bank (organized in 1934), and the Agency for International Development (organized in 1961). The International Bank for Reconstruction and Development (World Bank), which is owned by 106 member countries, began operations in 1946. It is affiliated with the International Development Association as well as other international financing institutions. The Inter-American Development Bank (organized in 1959), a hemispheric version of the World Bank, has a membership of all Latin American countries except Cuba.

Most of the discussion which follows will be devoted to the U.S. architects' and engineers' foreign operations as these relate to the works generated through loans made by the above organizations, since they have created the market and will involve most of the technical employment.

In general, none of these organizations will approve loans to a country or a private enterprise for a development project unless they have assurance the borrower will provide competent technical planning and supervision of the construction for the works that have been generated by the loan. Since each of the organizations has been established under different conditions and operating regulations, there are differences in the manner in which architectural and engineering consultants are employed and used.

The Export-Import Bank lends only dollars, which means that these funds can only be used for employing U.S. firms. It is the responsibility of the borrower to find a firm satisfactory to the Bank, and then to negotiate a contract acceptable to the Bank with the firm.

The Agency for International Development, to a large degree, makes dollar loans; but, in some areas (primarily in the Latin American region), it may lend both dollars and local currencies. Dollar loans can only be used for the procurement of U.S. services, while loans that include local currencies can be used to employ either U.S. or qualified local architectural and engineering services. Regardless of whether a U.S. or a local firm is employed, the dollar portion of the loan can

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only be used to reimburse the dollar costs of the work, while local currencies must be used for the local costs. For example, a U.S. contractor would pay in dollars the salaries of his U.S. employees, the home office overhead, profit, travel and any other U.S. costs, while the salaries and wages of local employees, local travel, per diem, and other local costs, would be paid in local currencies.

All consultant services required by borrowers under A.I.D. financed loans must be advertised in the *Commerce Business Daily*. This publication can be obtained by subscription through the Superintendent of Documents in the U.S. Government Printing Office. As with the Export-Import Bank, the borrower must find a firm acceptable to A.I.D. and then negotiate a contract with that firm that will be acceptable to A.I.D. When the borrower is a financial institution that makes sub-loans, the organization obtaining the sub-loan employs its own architects or engineers.

Consultants employed under World Bank loans must come from a member country of the Bank or Switzerland. The borrowers are required to employ consultants when their own technical resources are judged by the bank to be inadequate for the work. The borrower furnishes the Bank a list of firms considered qualified, and technical proposals are then obtained from the firms approved by the Bank. A contract is negotiated by the borrower with the chosen firm, which then must be approved by the Bank.

For work under Inter-American Development Bank operations, consulting professional services are normally used by either the Bank itself or by a borrower. The Bank maintains a Professional Services Contractor File open to registration of firms from countries in the Free World. When it employs a professional firm, it makes a selection from those listed in the Contractor's File. When a borrower selects the firm, the Bank must approve the selection procedure used, the list of firms from which the borrower intends to request proposals, and the terms of reference for the contract and the contract.

The international financing agencies are not interested in approving a firm to act as a consultant on one of their projects and then function merely as an employment agency for technicians. Firms must show adequate experience and available staffing in key positions on the project to be considered acceptable for such work.

Joint Ventures

Joint ventures have become quite popular in some of the countries during the past few years, and, if are arranged satisfactorily, benefit both the U.S. and the local firms. In a joint venture, the advantage would rest with a U.S. firm in that it would have the local firm's knowledge of the local working conditions, the tax laws and the labor laws, in addition to its own available supply of engineers, surveyors, draftsmen, and other technical staff. The local firm would gain by receiving employment they could not otherwise qualify for, along with the opportunity of gaining experience in the U.S. firm's methods, organization, and operations. A local affiliate would also have the opportunity of watching for new job possibilities for the U.S. firm.

Consultants

In considering the overall field of architecture and engineering, architects in the foreign countries are probably doing a larger percentage of the local technical work than is the case in any of the other professional fields. Most of the large civil, electrical, mining, and chemical engineering projects have been engineered by either U.S. or European firms. On the other hand, a large portion of the architectural work has been done in many of the foreign countries by local architects.

A consultant working in a foreign country must realize that he will be working under conditions which may, from time to time, not be under his control. Although he prepares his plans, specifications, and bid documents in about the same way that he would in the United States, he would have to plan the contractor's construction schedule in a somewhat different manner. In both the Latin American and Asian areas there are many religious and national holidays that sometimes result in a work slowdown that could last from a week up to a month. Seasonal changes in weather may stop work or have serious interference with transportation to the job site. The job mobilization period and the construction schedule would be much different if these were started in the rainy or the dry season. Imported materials would have to be ordered well in advance of need, since it could take up to four or five months from the date of order to the date of delivery, with the possibility the material being held up in the local customs office for another month. These are some of the factors that must be considered in planning a construction schedule on a foreign job.

The development of cost estimates for a project has been a continuing problem with consultants working overseas. Low contract bids have often exceeded the consultants' estimate by 20% or more. In making cost estimates the consultant must become intimately acquainted with local construction conditions, such as: local construction practices; the availability of material that can be procured within the loan fund limitations; the availability and quality of labor and the laws controlling their use; the possibility of inflation within the country and allowance for escalation within the contract; the laws regarding the importation and exportation of construction equipment of a foreign contractor; the factors relating to mobilization and deobligation; and the potential contractor's interests in the specific project. Without due consideration to these factors, as well as other associated conditions, it would not be possible for a consultant to make a realistic cost-estimate. In one instance, a consultant used practically the same unit prices that had been bid on a similar job six months previously, and then found the low bid to be 23% above his estimate because of a different contractor's interest in the job.

Consultants' working conditions on foreign projects will vary from country to country. Usually the U. S. consultant tries to use as many local architects and engineers as possible, confining his U.S. employees to the managerial and supervisory capacities. In some countries there are an ample supply of college trained architects and engineers available for such work. In some there are fairly well established consulting firms that can be used in joint ventures. In others there are practically no local consulting firms and relatively few capable graduates. The Commercial Attaches in the U.S. Embassies usually have knowledge of the availability of responsible consulting firms within the country they are working, and will make such information available to interested U.S. firms.

Consultants working on foreign assignments are paid under the procedure established by the government for direct employment or in accordance with regulations of the agency financing a project under a loan. This might involve a letter of credit in a U.S. bank for dollar disbursements, local currency payments by a Ministry of Finance or by the disbursing officer in a U.S. Embassy, direct payments to the consultant by the organization financing the project, or a combination of such methods. Delays in payments, especially during the beginning of work on a project, can occur in which case consultants should be financially able to carry their own financing during such periods. Although this is not a common problem, it can happen under various conditions. Changes in a local government may cause delays in progress payments, but these have rarely resulted in the cancellation of a project.

In some instances consultants have been paid in dollars by the financing agency for their dollar costs and their local costs. In other instances, they have been paid, either by the borrower or in part by the financing agency, in local currencies. Occasionally, their dollar and local costs could be paid in part, or in total, by two different financing agencies (one paying the dollar costs and the other the local currency component). A consultant must assure himself that his method of payment for both types of currencies is clearly defined in his contract.

Local labor laws and tax laws, as related to consultants' work, should be given due consideration by a consultant when he negotiates a contract in a foreign country. Without such knowledge, he may, for example, find himself paying an extra month's salary to his local employees each year as well as a stiff severance pay consisting of months of salary or wages for employees he would discharge. Tax requirements will also vary from country to country. Therefore, the consultant must know what he is required to pay, and then must arrange to cover these items in his contract. Local attorneys and local professional consulting firms are sources of information about these matters, and in some of the more sophisticated countries, English versions of the labor and tax laws are found for sale in pamphlet form.

A U.S. architect or engineer working for a foreign government must realize that there can be, and often is, an uncommonly long delay between the time his firm is chosen and the time a contract is signed. There have been instances in the Agency for International Development where borrowers completed contract negotiations and signed contracts in a matter of days, but these are not the usual cases. Lengthy delays, weeks and sometimes months, may necessitate several visits to a country by the consultant before a contract is signed. The delays may be caused by normal operating procedures within a government—in one instance, a contract required five government signatures involving three departments before it had clearance —or may be caused by the normal slowness of the government or the financing agencies' procedures.

Although none of the international financing agencies approve of competitive bidding for architectural or engineering services, the opportunity will, from time to time, arise where the consultant will be requested to include a price with his technical proposal. Usually, by the time the financing agency has learned of the situation and brought the borrower back into ethical practice, a number of U.S. firms have formally presented the borrower with bids for the work. Everytime this is done by the U.S. consultants and they break over the ethical line, it becomes more of a problem for the agencies to insist on ethical practices the next time the selection of a consultant is required. It is difficult for a foreign government representative or businessman to understand what the financing agencies claim as ethical practices with the consulting fraternity when some U.S. firms are willing to offer a price with a technical proposal, or are willing to be considered on a price basis when a contract is under negotiation with another firm.

The U.S. consulting fraternity has an excellent opportunity to bring its advanced technical and operational knowledge to lesser developed countries, and to gain and hold the respect of the local technical profession. In some instances this has been done, and a strong mutual regard has resulted to the advantage of both the U.S. and local professional groups. In other cases, where U.S. consultants' efforts have been unsatisfactory, a serious reflection on U.S. consulting firms' practices and integrity has resulted.

Quality Must be Maintained

We must realize that in some countries, especially in Latin America, there is resentment among the local government and professional circles about the use of U.S. firms. They say U.S. firms are expensive and do not always do good work. They ask the question, why shouldn't local engineers be used? They have the same college degrees as the U.S. technicians and many are graduates from U.S. or European colleges. In countries where this feeling is prevalent, utmost care must be taken to see that a competent project staff is assigned to the project. Poor technical work or job operations in any one of these countries can immediately build local antagonism toward U.S. consultants.

It is absolutely necessary that a competent project manager be in charge of every U.S. firm's overseas operation—a man who can converse technically with the borrower's representatives and the contractor on all matters relating to the work. If the job calls for highly specialized types of technical assistance, he must have it available as needed to keep the work going smoothly. He should be able to speak the language of the country; and if he cannot, he should have a competent translator with him in all discussions. He must be tactful and able to gain the confidence of and to work with foreigners at all project operation levels. Above all, he must recognize that people, customs, and working conditions are different than those found in the United States, and, accordingly, must be able to adjust to local conditions.

Types of Facilities

In the field of architecture, the foreign assistance operations cover the field of housing, education and health facilities, as well as building construction associated with airports, harbor developments, industrial plants, etc. Funds are made available by some of the international financing agencies for direct housing projects for funding to banks, relending for housing, seed capital for saving and loan associations, and guarantees to U.S. investors for housing construction in foreign countries.

Most of the housing investments have been for low-income groups. These involve housing and apartment projects constructed in their entirety by contractors, housing projects involving a portion of self-help construction by the owners, and individual housing financed through banks or savings and loan associations.

In general, an effort is made to utilize local materials as much as possible (usually bricks, concrete, tile, and lumber). In some countries, a portion, if not all, of the hardware, plumbing, and electrical supplies are manufactured locally; otherwise, they must be imported from the sources specified under the loan agreements. The planning and supervision of construction is under the control of architect-engineers, with most of the work being done by contractors chosen through the competitive bid process.

School construction—covering primary, secondary, and university levels—is also planned. Construction is to be supervised by architect-engineers and carried out by contractors. Primary school construction loans may involve many schools located throughout the country where controlled planning and operations require the services of a firm experienced in organizing and supervising such operations. Some construction is of a self-help nature, where local citizens furnish the site, construction materials, and at times some of the labor. Basic designs are usually used, and are adjusted only to site and climatic conditions.

Secondary schools and university buildings, which are usually located in or near the larger towns or cities, tend to have architectural plans comparable to the conventional lines and layouts of similar U.S. schools. The design of such school buildings by U.S. architects is a problem, at times, when the architect tries to give the buildings the full treatment, as he does in planning a U.S. school. These countries require a building design that is structurally sound, and a utilitarian layout that will give the maximum utilization of the space at a reasonable cost of construction. In many instances the new construction may be the first, or at least the first modern school of its kind in a community; and if the building is planned to meet the practical needs of the community, it will be the forerunner of future construction.

Maintenance has been and will continue to be a problem with school buildings in the lesser developed countries. Secondary schools and universities have a much better opportunity for improving maintenance since they are located in population centers, which usually have the facilities necessary for doing the maintenance. The major maintenance problem occurs with the small rural primary schools, where there is often neither the facilities for maintenance or the desire to do the maintenance. Under these conditions, it is advisable to build maintenance into the building design by including simple, but substantial, construction that will require little maintenance.

If a U.S. architect or engineer can enter into a foreign project with a sound contract, a clear understanding of the job to be done and the local conditions under which it must be done, and if he will staff the job with a competent project manager and key personnel, he will establish and maintain the respect of the owner and the local engineering fraternity, and at the same time stay within the ethical bounds of his profession. He should then have an excellent chance of making a success of the work. ☐

Department of Commerce Assistance to U.S. Business

by

S. David Horner

The U.S. Department of Commerce recognizes the great need for more and better housing, both here and abroad.

From the time Congress established the Department of Commerce as a separate Department of the Government in 1913, the Department's prime responsibility has been to foster, promote, and develop the Nation's foreign and domestic commerce, its manufacturing and shipping, and its many and varied industries.

Mission of the Commerce Department

Our mission, simply stated, is: to inspire the Nation's economic growth and to guide its advancement in keeping with the established free enterprise system; to search out and identify economic opportunities that will spark business and industry; to promote the use of our scientific and technological resources for advancing the Nation's industrial capacity; and to provide business with economic research information so essential to industrial growth and development.

Bureau of International Commerce

Our Bureau of International Commerce is the principal Government link between the business community and foreign commercial markets. We help businessmen in many ways, emphasizing the importance of expanding U.S. exports:

1. Staging commercial exhibitions abroad (special U.S. shows and U.S. participation in international trade fairs). Operating six permanent U.S. Trade Centers overseas where American businessmen show and sell their products.
2. Sponsoring Trade Missions which carry business proposals from U.S. companies to potential customers abroad and which bring back proposals from overseas.
3. Maintaining an automated American International Trader's Index containing the names of 23,000 American firms interested in foreign trade. New computers enable the Department to give swift notification to these firms about market developments affecting their products.
4. Having Trade Lists that give names and addresses of foreign firms handling specific commodities.
5. Arranging for Trade Contact surveys, which are made by U.S. Foreign Service officers to help them find overseas companies specifically interested in handling an American manufacturer's product.
6. Having World Trade Directory reports, each containing specific information on the business standing and sales competence of a firm abroad.
7. Putting out many other publications including a weekly magazine, *International Commerce,* that report on economic an dtrade conditions abroad.
8. Helping small business firms work out export strategy, often by lining them up with Combination Export Managers or with large manufacturers with established export organizations.
9. Providing a business travel service for businessmen planning trips abroad.
10. Having information available on foreign business practices, trade and commercial policy, transportation, insurance and international finance, all of which should be helpful to any U.S. businessman interested in foreign trade.

Our trade experts and country specialists are available at all times for consultation with U.S. and foreign businessmen and officials to determine the need for, and to provide international marketing information. These specialists provide useful data on the housing picture in the developing countries.

In the area of housing in the developing nations, we provide assistance and guidance to U.S. firms on investment and licensing abroad. Because of the balance of payments problem, we are currently limiting this assistance to the developing countries. We conduct a counseling service, which includes introductions to foreign investment promotion offices and to other U.S. Government agencies and programs, a Foreign Investment Checklist, and information about available assistance programs.

Elsewhere in the Bureau of International Commerce, a Foreign Business Practice Program maintaining surveillance on the treatment private business receives abroad.

S. David Horner is Director, Investment Resources Division, Office of International Investment, U.S. Department of Commerce, Washington, D. C. A mechanical engineer, Mr. Horner formerly was with the Carrier Corporation in Rangoon, Burma.

Business and Defense Services Administration

In the Department of Commerce the domestic counterpart to the Bureau of International Commerce is the Business and Defense Services Administration. BDSA, as we call it, is the business services agency of the Department. Its mission is to provide professional counseling on business problems; to develop recommendations for sound public policies related to business; and to supply industrial information and analyses on which public policy decisions can be based.

BDSA can be helpful in the international housing field in many ways:

1. BDSA's industry analysis program compiles statistics in useful form, forecasts industry trends, and publishes marketing information, including foreign trade developments.
2. BDSA industry and commodity specialists zero in on the worldwide sales potential of specific commodities.
3. BDSA promotes the adoption of commodity standards and specifications to help American businessmen compete more effectively in world markets.
4. BDSA specialists conduct constant analyses of the effect of tariff reductions on American industries and on other regulations and controls affecting our business abroad.
5. Through its trade opportunities program, BDSA disseminates specific foreign business proposals reported by Foreign Service posts.
6. Through a commercial invitation program, BDSA refers foreign businessmen coming to this country to U.S. businessmen with whom they might develop a trade relationship.

Field Offices

Last, but far from least important of the Commerce Department programs for developing working arrangements between U.S. and foreign businessmen, is the Field Office program.

We staff the Field Offices with international trade specialists who offer a complete range of services. These include step-by-step assistance on how to get started in world trade, help in locating overseas partners and distributors, and advice on financing exports and overseas projects. Our Field Offices can also get information for you about customs duties and trade regulations of foreign countries, import quotas and exchange controls, licensing procedures, documentation requirements, credit and investment insurance, or procurement financed by the Agency for International Development.

Working closely with the Field Offices are the National and Regional Export Expansion Councils. A Regional Council has been organized in each Field Office area, with the Field Office director serving as executive secretary. Each Council advises newcomers to international commerce, conducts international conferences and seminars, and otherwise distributes information about international trade matters.

Export Expansion Program

At the present time we are preparing for large-scale expansion of these various efforts, with the primary obective of getting U.S. businessmen to devote more attention to exporting opportunities.

To assist in the development of specific market opportunities, we would establish a new joint government-industry export program. Trade associations, groups of firms, or their representatives, would have a choice of either working closely with the Commerce Department or of actually signing a contract with the Department. The close working arrangement involves a sustained, integrated sales campaign supported by the Department's export promotion techniques (trade missions, trade fairs, trade centers, additional market research and other activities). Participating firms would pay the normal costs.

The contractual arrangement—the proposed Joint Export Association program—would be broader in scope. Trade associations or other groups of firms would get Government financial help for systematic development of overseas markets for particular products over a sustained period. The Government would share the costs of advertising, publicity, participation in trade fairs, market research, supplying samples and technical data, overseas trade promotional visits, and training of sales and service personnel.

The objectives of these programs are to assist companies to enter new markets, to introduce new products abroad, and to obtain for U.S. suppliers an increased share of existing markets.

We hope to double our commercial exhibitions in trade fairs and to open additional U.S. Trade Centers overseas, while aiming at a three-fold increase in the number of U.S. firms participating in these promotions. Our records show that for every taxpayer dollar invested in our commercial exhibitions, 15 dollars is returned to the United States through first-year export sales by exhibitors.

Another goal of the five-year program is to expand and increase business participation in trade missions, mobile trade fairs, and America Weeks displays in foreign department stores.

The part of the export expansion effort that might be of greatest interest is our plans for a full-scale development and service center program for developing countries. We hope to set up trade and development service centers in Asia, Africa, the Middle East, and Latin America.

These are our programs for assisting the U.S. businessman, and our plans for the future. These programs can help you find what you need to know about housing in the developing countries. ☐

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1969

The Building Research Institute is a component of the Building Research Advisory Board of the Division of Engineering, National Research Council. The National Research Council was organized by the National Academy of Sciences in 1916 in order to provide for a broader participation by American scientists and engineers in the work of the Academy. The Academy was chartered by Congress in 1893 as a private organization with a responsibility for advising the Federal government in science and technology. Since this responsibility is now shared with the National Academy of Engineering, organized in 1964 under the original NAS charter, the Research Council serves, in effect, as an operating agency for both Academies.

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JOURNAL OF THE BRAB BUILDING RESEARCH INSTITUTE

building research

VOLUME 6, NUMBER 3

JULY/SEPTEMBER 1969

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Building Research is published quarterly by the BRAB Building Research Institute, National Research Council, 2101 Constitution Ave., N.W., Washington, D. C. 20418. BRI members receive *Building Research* as a membership service. Subscription rates to non-members: $35 annually; $9.00, single copy. Special rate for college, university and public libraries; $20 annually. All subscriptions payable in advance in US funds. No discounts. Additional subscriptions or copies to BRI members or employees of member-organizations, $12 annually; $3.50 single copy.
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Building Research is intended as a means of disseminating information which has been, (1) presented at BRI conferences, workshops, and symposia, (2) developed by BRI Technical Committees, and (3) submitted by researchers involved in housing, building and/or environmental design. It is directed towards those who are involved in or interested in building science and technology and serves as a forum for presentation and discussion of pertinent topics.

BRI

The BRAB Building Research Institute is a national, interdisciplinary organization with an international membership dedicated to the science and technology of building.

The Institute encourages and stimulates needed research and development in the many diversified areas of the industry and its allied professions, and aids in the communication of ideas through the collection, correlation, documentation and dissemination of building science and technology information.

Membership is open to all individuals with an interest in the advancement of building science and technology.

The diversity of its membership is one of BRI's greatest strengths, enabling it to function across disciplinary lines and bring together those in a position to contribute to advances in building technology.

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building science news

Ross Pursifull Appointed To BRI Operating Committee

Ross W. Pursifull, AIA, an Associate in the Detroit based Architectural - Engineering firm of Smith, Hinchman & Grylls Associates, Inc., has been appointed a member of the BRI Operating Committee to fill an unexpired term, it was announced by Edward T. Schreiber, Chairman of the Operating Committee.

Pursifull has served as Chairman of BRI's Technical Committee on Office Practice and Procedure for the past several years. He has contributed a wide variety of technical papers to the Institute and is a nationally recognized authority on building technology.

BRI Fall Conference Set for November 5, 6 & 7

With a goal of 26 million units of new housing to be built over the next ten years, America is faced with a housing crisis of considerable magnitude. Will the Nation's building industry be able to respond effectively? Will there be sufficient natural resources to satisfy the increased demand? Do we have sufficient research and development programs to increase our resources or expand them?

It is generally agreed that America can and will respond effectively and that a large part of the answer lies in the role of industrialization. The Nation's building process must become even more systematized and mechanized than it has been in the past.

Such questions and hypotheses will be explored in depth at the Building Research Institute Fall Conference, "The Crisis in Housing-The Role of Industrialization" to be held at the Hotel America in Washington, D. C. on November 5-6-7. The 2½ day conference will provide opportunity for a broad and in-depth exploration of the current and probable responses of various segments of the housing industry.

Nationally known professionals will address themselves to the housing crisis and the Response of the Community, Response of the Government, Response of the Manufacturer/Fabricator, Response of the Professional, Response of the Builder/Developer, Response of Labor, and the Response of the Financier.

The highlight of the conference is to be a presentation regarding progress of the Department of Housing and Urban Development's (HUD) OPERATION BREAKTHROUGH for the design, testing and evaluation, and prototype construction of complete housing systems which can lead to volume production. HUD has issued a request for proposals which must be submitted by September 19, and expects to announce the first contract awards soon thereafter.

Some 700 architects, engineers, builders, developers, manufacturers, researchers and government people are expected to attend the conference. BRI's purpose in holding the meeting is to provide a forum for discussion by professional and industry people of the progress and shortcomings of the industrialization of building and its relation to the housing crisis. BRI is a technical society dedicated to the advancement of the science of technology of housing, building and environmental design.

Conference registration fee for BRI members is $50; for non members $75. Federal government employees admitted to sessions without charge upon special request.

U.S. Plywood-Champion Papers, Inc., Receives Award

Forest Products Industry Awards—the forest industries highest honors—were presented May 13 to five individuals and two organizations (one, a BRI Organizational Member) in recognition of superior accomplishment and outstanding service to the forest products industry.

Presentation of the awards highlighted an Awards Dinner held in conjunction with the 67th Annual Meeting of the National Forest Products Association in Washington, D. C. The award ceremonies marked the eighth annual presentation of the industry's achievement awards.

The nine laboratories comprising the U.S. Plywood Group Laboratories were honored for pioneering innovative applied product research and development programs with demonstrated benefits to the company and to the entire forest products industry. Applied research studies in such diverse technical areas of acoustics, fire retardants, structural design, chemistry and combinations of wood and other materials were initiated for the development of a new series of wood-based products to meet a demonstrated market demand. Product innovations, introduced this year, include two types of acoustical wood doors and a rated wood fire door with lights.

The award was accepted for U.S. Plywood Group Laboratories by BRI member Raymond C. Platow, vice president of research and development, U.S. Plywood-Champion Papers, Inc., New York.

Harry B. Zackrison, Sr. Receives Fitzpatrick Award

Harry B. Zackrison, Sr., member of the Executive Committee and past chairman of the Board (BRAB), and Chief of the Engineering Division, Military Construction, Office of the Chief of Engineers, U.S. Army, received the 1969 F. Stuart Fitzpatrick Memorial Award at ceremonies before the annual convention of the National Association of Professional Engineers (NSPE) meeting in Kansas City on July 9.

The F. Stuart Fitzpatrick Award is made periodically to a living American who has demonstrated dedication, action and exceptional effort in fostering cooperation within the construction industry and who has given outstanding service toward unifying the various segments of the industry. The award, a silver medallion, and an appropriate scroll, are presented at a meeting of the recipient's major professional society.

The Award, established in 1960 in memory of F. Stuart Fitzpatrick, for many years manager of the Construction and Civil Department of the National Chamber of Commerce, is administered and supervised jointly by BRAB (formerly by BRI), the American Institute of Architects (AIA), the Associated General Contractors of America (AGC), the National Association of Home Builders (NAHB) and the Producers' Council, Inc. (PC).

Mr. Zackrison, the seventh recipient of the award, was cited for his many years of service to the construction industry. Mr. Zackrison has been chief of the Engineering Division, Military Construction, in the Office of the Chief of Engineers since January 1952. In that position he is responsible for engineering criteria and performance of a multibillion dollar construction program performed by the Corps of Engineers for the Air Force and the Army.

Mr. Zackrison has been twice presented the *Exceptional Civilian Service Award,* by the U.S. Government, first in 1945 for his outstanding performance during World War II, and again in 1966 for his outstanding technical and administrative leadership to worldwide elements during the period 1952-1965. He also received the American Standards Association Award in 1955 for his outstanding and continuous work in the development of modular coordination.

Mr. Zackrison is currently a member of the BRAB Executive Committee and was formerly Chairman of the Board. He serves as the U.S. National Committee representative on the International Council of Building Research Studies and Documentation (CIB).

Mr. Zackrison received his Bachelor of Science degree in Civil Engineering from Worcester Polytechnic Institute, Worcester, Massachusetts, in 1926. After graduation, he was employed by the Stone and Webster Company, Boston Engineering firm, the Pennsylvania Water and Power Company at Baltimore, the Allied Chemical Corporation in Virginia, the New England Power Company at Boston, the Vermont State Highway Commission, and finally, the Department of the Army where he has been since 1933. He is a member of Tau Beta Pi and Sigma Xi, honorary professional and scientific fraternities.

Fourth Australian Building Research Congress

The Fourth Australian Building Congress will be held over a period of three days in August 1970 in Sydney. Exact dates are at present being determined.

The theme of the Congress is to be the modern multi-storey building and papers and discussion are intended to range over regulatory, economic, and social aspects of the theme as well as to deal with modern developments in the more familiar fields of design, materials, long-term movement, and the like.

The Commonwealth Experimental Building Station, the host organization for the Congress, feels that, although the primary purpose of the Congress is to bring together the Australian building industry and Australian building research, the subjects to be discussed will nevertheless be of definite interest to your organization and that you will wish it to be represented at the Congress.

The purpose of the present early notice is to permit you to begin to organize the trips of members of your staff whom you might wish to participate.

The Experimental Station will supply further details of the Congress as the organization proceeds, and will supply on request details of the various types of accommodations.

Richard H. Tatlow To Receive PEPP Award

The second annual PEPP Award for outstanding service to the private practice sector of the engineering profession has been presented to Richard H. Tatlow, III, P.E., ex-chairman of the Board (BRAB) and president and director of Abbott, Merkt & Company, New York-based engineering and architectural firm. PEPP is the Professional Engineers in Private Practice section of the 65,000-member National Society of Professional Engineers (NSPE).

The Award was made at the PEPP Annual Dinner in Kansas City on July 8, by Harry E. Bovay, Jr., P.E., chairman of the PEPP Awards Committee. The dinner is part of the 35th Annual Meeting of the National Society.

Mr. Tatlow was selected to receive the PEPP Award for his "outstanding contribution to the advancement and recognition of the role of private practice in serving the public interest and the engineering profession." Nominations for the Award were made by recognized state PEPP sections as well as by individual members of PEPP.

A civil engineering graduate of the University of Colorado, Mr. Tatlow served as president of the American Society of Civil Engineers for the 1967-68 administrative year and recently completed a two-year term as chairman on the Committee of Federal Procurement of Architect-Engineer Services.

Prior to joining Abbott, Merkt & Company at the close of World War II, Mr. Tatlow spent some 12 years with the Kansas City firm of Harrington & Cortelyou. During World War II, he attained the rank of Colonel in the U.S. Army and was awarded the Legion of Merit for his wartime services.

Mr. Tatlow was one of the founders and has been a member of the board of directors and the executive committee of NUS Corporation since its inception in 1960 as Nuclear Utility Services, Inc. The company provides consulting and engineering services to the nuclear power field. Mr. Tatlow also serves on the board of directors of Consultec, Inc., a wholly owned subsidiary of the NUS Corporation.

A registered professional engineer in 21 states and the District of Columbia, Mr. Tatlow is a member of the National Academy of Engineering. In 1964, he was appointed by the National Academy of Sciences to its Committee on the SST-Sonic Boom, formed to study the effects of sonic boom phenomena as they relate to the development of supersonic transport aircraft by the U.S. at the request of President Johnson. Mr. Tatlow also is a member of Mayor John V. Lindsay's New York City Science and Technology Advisory Council.

In 1968, Mr. Tatlow received the Distinguished Engineering Alumnus Award from the University of Colorado.

NBS Studies Weatherability Of Plastics

Prediction of a plastic's weatherability is the goal of a current study at the National Bureau of Standards (NBS) Institute for Applied Technology. The study is being conducted by J. E. Clark and J. A. Slater, NBS Research Associates under sponsorship of the Manufacturing Chemists' Association, in cooperation with G. E. Fulmer of the W. R. Grace and Co., and R. C. Neuman of the B. F. Goodrich Chemical Co. Numerous appearance, physical, and fundamental properties of plastics are being examined in simulated and outdoor exposures. This phase of the study deals with the changes in tensile and flexural properties resulting from outdoor exposure.

G. E. Fulmer, of W. R. Grace and Company's Research Division (left) and J. E. Clark, (right), Manufacturing Chemists' Association Research Associate at the Bureau, examine a specimen of plastic.

To date, measurements have been made on twenty plastics composed of six base polymers that were exposed for 24 months in Arizona, Florida, and Washington, D. C.

All 20 plastics were subjected to modified ASTM tensile tests. Five parameters were then obtained from the resulting stress-strain curves. These included Young's modulus of elasticity, yield stress, yield strain, failure stress, and ultimate elongation at break.

The ultimate tensile elongation and 5 percent flexural stress showed the greatest change with time. Ultimate elongation decayed rapidly within one year for most of the plastics. Five percent stress increased substantially in a few months after which there was little or no change. An increase in 5 percent stress was usually accompanied by a decrease in ultimate elongation. These changes indicate a loss of elasticity and flexibility, resulting in increasing stiffness and probably brittleness.

Using ultimate elongation and 5 percent stress, percent retention of initial value was found to be a useful measure for classifying the plastics. Smooth curves fitted for the percent retention of initial ultimate elongation show a definite exponential decrease.

In general it was found that the plastics performed worst in Arizona, best in Washington, D. C., and intermediate in Florida. Actinic radiation and heat appear to be the primary agents causing physical degradation. Washington, D. C., exposed samples, however, sometimes exhibited a greater loss of physical properties than Florida exposed samples, possibly indicating effects of moisture and air pollution.

Results of this study are reported in "Outdoor Performance of Plastics," Technical News Bulletin 53 (5) 1969, National Bureau of Standards, Office of Technical Information and Publications, U.S. Department of Commerce, Washington, D. C. 20234.

James L. Haecker Appointed Section Chief at NBS

BRI member James L. Haecker, AIA, has joined the staff of the Institute for Applied Technology at the National Bureau of Standards. He has been appointed Chief of the Scientific and Professional Liaison

Section in the Bureau's Building Research Division.

He will provide necessary liaison between professionals in the building industry, and the physical scientists, engineers and mathematicians at the Bureau. He will also promote an interchange of information and ideas concerning the philosophy, methodology, and problems of these two groups.

Mr. Haecker comes to the Bureau from the American Institute of Architects where he was Director of Research Programs. As Director of Research, Mr. Haecker served as staff executive to many national AIA Committees concerned with architectural education and research. His position with the AIA necessitated liaison with all elements of the environmental design professions as well as governmental and private agencies.

Born in Hamburg, New York in 1932, he received his Bachelor of Architecture and Master of Architecture degrees from the University of Michigan. Mr. Haecker taught in the Department of Architecture at the University of Michigan and served as a Research Associate on various research projects conducted by the Department of Architectural Research, the Architectural Research Laboratory, Ann Arbor, Michigan.

AISI Research Awards Given

Three schools of Architecture have received grants from American Iron and Steel Institute as part of the continuing program to encourage the development of new thoughts and concepts in the use of steel in building design and construction. It is felt that the subjects chosen will further encourage research leading to the improvement and advancement of technology in structural analysis and design.

(1) *University of Illinois at Chicago Circle, Chicago, Illinois.* "Industrialized Urban Housing." The proposed work involves a feasibility study of alternate system concepts for utilization of various types of steel industrialized building in conjunction with several possible means of accomplishing construction.

(2) *Rensselaer Polytechnic Institute, Troy, N. Y.* "Fire Protection in a Rational Building Code." The objective of the proposed study is to introduce a team of students to the broad problem and current attempts at incorporating community, property, and life safety into building codes; and to develop a rational approach aimed at incorporating fire protection in building codes.

(3) *Washington University, St. Louis, Missouri.* "A Three-Dimensional Cable Network Supra-Structure, Applicable to a Community Embodying Residential, Commercial, and Recreational Facilities." The proposed study is an extension of research on a lightweight tensile structure with prefabricated room box units. Architectural, structural, and technological problems will be investigated by development of design models.

These awards are made each year on the basis of a competitive judging of proposals submitted to the American Iron and Steel Institute. Results of completed projects from past years can be found in various architectural publications.

Science Information Exchange

The Science Information Exchange of the Smithsonian Institution is a clearinghouse for information on current scientific research actually in progress. Government agencies and many non-Government agencies with major research programs actively cooperate by furnishing the Exchange with timely information on their current research programs and projects. Non-Government agencies include private foundations and fund-raising agencies, universities, industry, and individual investigators who wish to register their research. The Exchange is funded by The National Science Foundation supplemented by funds obtained from service fees.

The Exchange differs significantly from other library, documentation and technical reference services in several respects. It is concerned only with records of research planned or actually in progress. It does not receive progress reports, abstracts, or other forms of published research results. The Exchange compiles data and technical information for program management purposes at the request of directors and administrators of the cooperating agencies. The Exchange provides broad coverage of basic and applied research in all fields of biology, medicine, sociology, psychology, agriculture, and the physical sciences, with emphasis on interdisciplinary relationships. All technical information is handled, indexed and retrieved by a staff of well-trained and experienced professional scientists and engineers.

For further information write Science Information Exchange, 209 Madison National Bank Building, 1730 M Street, N.W., Washington, D. C. 20036

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calendar

November 5-7—BRAB Building Research Institute Fall Conference; "The Housing Crisis—The Role of Industrialization," Hotel America, Washington, D. C.

September 8-10—AIAA/ASTM/IES Space Simulation Conference (ASTM Committee E-21 on Space Simulation), International Hotel, Los Angeles, California.

September 29-30—Seminar on Building Construction Standards, ASTM Headquarters, Philadelphia, Pennsylvania.

October 2-3—Society of Plastics Engineers; Plastics in buildings, Marriott Motor Hotel, Chicago, Illinois.

October 6-9—Council of Educational Facility Planners; Sheraton-Peabody Hotel, Memphis, Tennessee.

October 16-17—AIA Architect-Researcher's Annual Conference, Co-sponsored by Rice University, Marriott Motor Hotel, Houston, Texas.

December 7-12—ASTM Winter Meeting, Netherland and Terrace Hilton, Cincinnati, Ohio.

January 19-22—American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1970 Annual Meeting, San Francisco, California.

re-searching

by **Benjamin H. Evans, AIA,** EXECUTIVE SECRETARY

"How do you do sir? And what do you do for a living? What? Building Research? What's that? You mean working around with building materials —boards and bricks and stuff like that? What's that? The Psychology of spaces? Huh? Sociological aspects of whatzit? Economics—you mean, builders study about things like that? Industrialized processes—systems approach—computer graphics? Wow! New communities too, huh? I didn't know you people did research like that."

Such is a typical conversation between a researcher and a layman about building research. The average person is not aware that there are so many different facets to research for the planning, design and production of the physicial environment. He is not aware that there is research going on in these areas, nor does he have any concept of the interrelationships of the various facets.

When I started my career in research back at Texas A&M in 1949, there was very little research in progress in the building field except in the industrialization and new product area. A researcher had to look hard and turn over a lot of logs to find other people who were working in the same field. They were there, but they were hard to find. You had to struggle to find a journal that would publish a scholarly paper, unless the research happened to fit neatly into one of the traditional disciplines. A man with a report on "the psychology of space" or "computer graphics" would most likely find publication difficult during that early stage of development. Likewise, a man with a research project to be discussed had some difficulty in finding a group of peers to listen and respond to his hypotheses.

All that began to change as the Building Research Institute was formed and started to uncover and bring together the researchers and technologists working in the field. BRI offered for the first time an opportunity for persons from all disciplines to meet together to talk about their work in the building field and explore matters of mutual concern. Finally, the BRI Journal came into being and offered a medium for publication of building research papers.

But the last chapter in this story has yet to be written. Within the last few years a number of new organizations have begun to spring up because some new areas of research haven't seemed to fit properly into the old organizations. Granted, some of the younger cats are just plain "anti-establishment." But it is also true that the one organization founded on a base broad enough to include every interest in the housing, building and environmental design field and intentionally structured so as to bring together as broad a forum as possible—the Building Research Institute—has not kept itself as alert and receptive as it should have to the needs and values of these new groups.

Among the new research oriented organizations, publications, and conferences popping up recently are, the Design Methods Group, the AIA Architect-Researcher's Conference, the Environmental Design Research Association, Architectural Psychology, *Environment and Behavior, Urban Research News, Urban Affairs Quarterly,* etc. There are a good many reasons why BRI could and should broaden its scope so as to bring the traditional industry into contact with some of these "new breeds."

Besides the new groups, many of the traditional professional and trade organizations are undertaking activities of a broader and more interdisciplinary nature. The ICED group (Interprofessional Commission on Environmental Design), which brings together several of the professional groups for top level discussion, is indicative of this, and there are other examples.

All of this points up the ever increasing need for a broad-based interdisciplinary, research and technical society—the Building Research Institute—which brings people together in a meaningful way and provides a necessary mechanism for improving America's physical environment. BRI has a golden opportunity to serve a pressing need and must not pass up its obligation. ☐

FARSTA, SWEDEN

Editor's Comment

In this issue Miss Jeanne M. Davis, AIP, Chairman of the Institute's Technical Committee on New Communities under Division I, discusses the New Town Concept in Europe and America as a prelude to publication in the next issue of *BUILDING RESEARCH* of the proceedings of the 1969 Spring Conference "New Towns: Frontiers or Failures?"

Miss Davis participated in the Spring Conference and has been assisting with the editorial chores in getting the conference papers ready for publication. Her article points up the tremendous impact of new towns on housing and the opportunity for designers, builders and manufacturers to think fresh new thoughts about the "rebuilding of America." The Spring Conference was so successful and the demand for papers so frequent, that after the October/December issue of the Journal which will include the conference papers, the proceedings will be dressed with a new cover and offered for sale to the public. Seldom have I heard so many compliments on the value of a conference.

The other papers in this issue were chosen at random to present a representative selection of research projects from both Europe and America. The National Swedish Institute for Building Research is one of the most prolific of all and has published some very interesting papers, such as this one on seasonal construction. The College of Architecture and Fine Arts at the University of Florida has activated its Bureau of Research and has several young professors at work, including Leland Shaw, who writes here about one of his projects in perception. Edward Willoughby, Chief Civil Engineer for Giffels and Rossetti, Inc. presented the last paper at a BRI Conference in 1967. Mr. Willoughby's comments on water pollution are even more relevant to the building industry today than they were two years ago.—BHE

European New Communities

by

Jeanne M. Davis, AIP

Most everyone agrees that what America needs is a better way of urban life. Urban development procedures now in effect, are not providing the quality of community amenities or even basic necessities for today's urban culture that is deemed necessary. It is generally agreed that we have the capability to meet the needs, but in order to do so and to build better communities we will have to use the best planning techniques (social and economic, as well as physical) we are able to devise. And we must make full use of the vast capabilities of building, engineering, transportation, and related technologies to provide a better environment for everyone.[1]

A decade ago, few people in the United States had heard the terms "new town" and "new communities." In the past year or two these and related terms have become almost as popular as the term "environment."

Increasing population, the continuing trend toward urbanization, the multitude of problems engendered by squeezing too many lower-income people in obsolescent buildings in decaying sections of cities built for a by-gone era—and isolating middle-income families in suburban cookie-cutter housing developments—are part of the background of present interest in "new towns." Rising expectations and demands for goods, facilities, and services available only to upper-income people only a few years ago; the construction of large areas where any housewife without an automobile is unable to buy a loaf of bread and children are forced to play in the street or trespass on neighbors' backyards—these are part of the circumstances bringing about a change to more rational types of urban development.

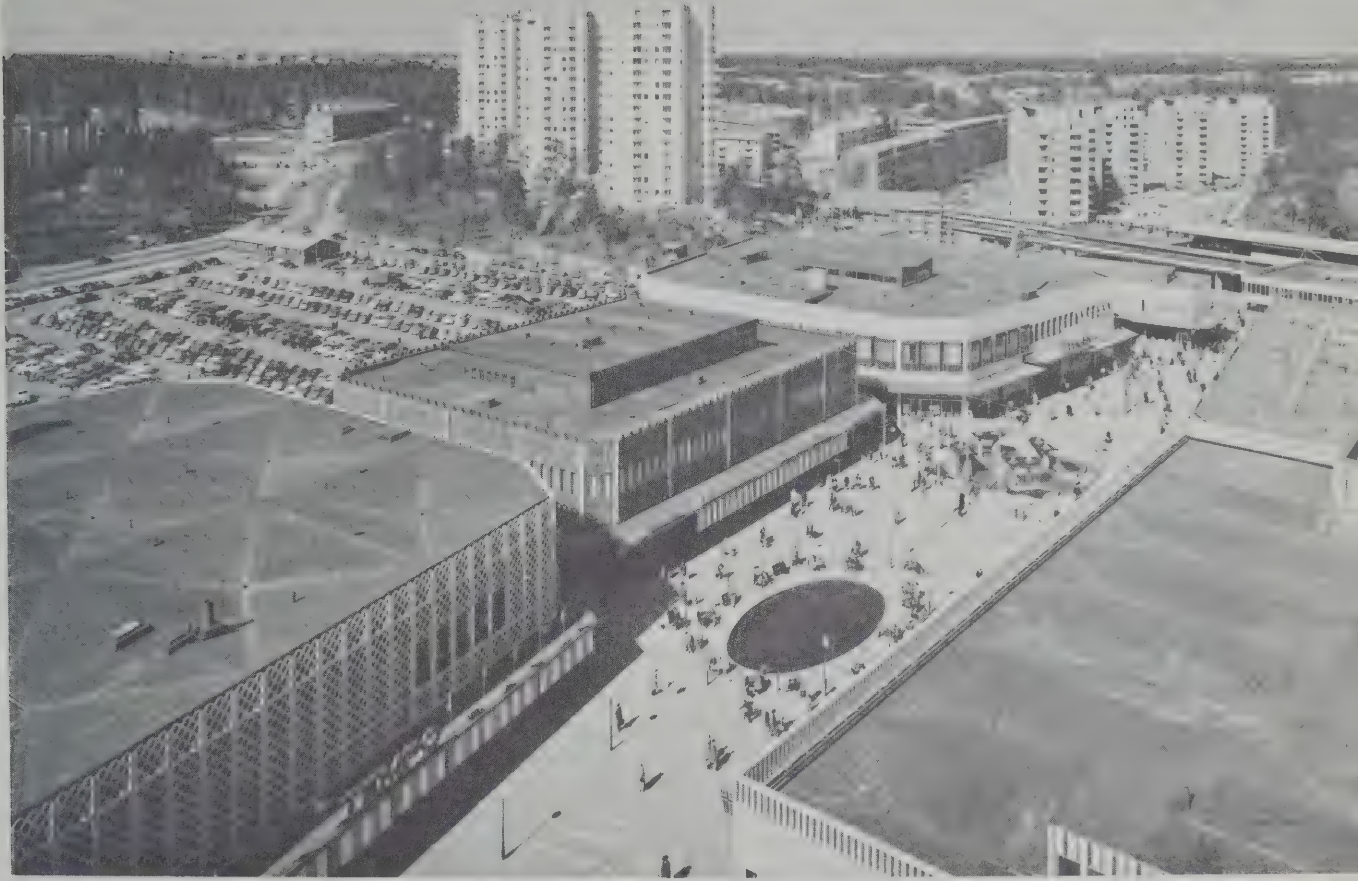
Cities and houses are supposed to be for people. But take a look at an aerial photograph of any suburban housing area built in the United States in the past 20 years. You won't need a scale to determine that in most areas almost as much land area is devoted to the automobile's movement, servicing, and storage as is provided for people's housing and related facilities.

If you're still sceptical, just look at the house plans in the real estate section of your newspaper. Compare the size of the garage with that of the family's livingroom. Few of today's automobiles could fit in the living room of most houses.

Somewhere along the way, we seem to have forgotten that the automobile is primarily a means of transporting people from one place to another. We also seem to have forgotten (except for the time it takes to read articles about man's need for exercise) that feet came first! In all too many suburbs, and in city areas also, there is no direct way to get from one place to another without the aid of four wheels and a motor—privately owned.

Other things we seem to have mislaid in the 1950s and 1960s include the need of older people to have their share in the life of a community; the need of small children to be able to play in safety within their mothers' view; the need of slightly older children to have open areas to play in, trees to climb, an unmanicured natural area in which to create their own brands of adventure or room to swing a bat or throw a football without breaking neighbors' windows; get-together-away-from-prying-adults centers for teenagers who want to run things their way; and space near home for the tired wage earner and his equally tired wife, to play a short game of badminton, swim, or send a golf ball

Jeanne M. Davis is an urban planner in the Land and Water Resources Branch, Economic Research Service of the Department of Agriculture. She is a member of the American Institute of Planners and was formerly a consultant to the Baltimore Regional Planning Council. Miss Davis specializes in new communities and has traveled and led tours all over Europe and America. She is chairman of BRI's committee on New Communities.



Apartment buildings of varied types are grouped around the Farsta shopping center. Residents of this Stockholm satellite community can reach downtown Stockholm in 30 minutes by subway.

across a putting green without having to hire a baby sitter or pack everyone into a car.[2]

What's wrong with this picture? In the United States, unfortunately, there are few communities where these facilities are *readily available* close to home for people of any income level. Only a relatively few upper-middle income families are so lucky, and, of course, the people who have managed to get a house in Radburn, New Jersey; Greenbelt, Maryland; or other well-planned older communities; and the people living in today's versions of these communities. Together, these accommodate only a small fraction of the total U.S. population.

Recreation space; access to shops, schools and community facilities; and separation of traffic are important. How would you like to cut your home-to-job commuting time to half an hour or less? Over a year, how much time and money would you save? Think about it for a while—especially the next time you're caught in a traffic jam. Providing opportunities for many people to work near where they live is another "plus" in a well-planned new community.

Do you think we can do better than we have? Of course we can. We must. Our physical environment and our social environment are deteriorating so rapidly that development of wisely located, well-planned, humanely designed, soundly constructed new communities utilizing the best of today's techniques and technology are a necessity for *now*—not the distant future.[3]

Some Lessons from History

Since ancient times, examples of planned communities (carefully planned to serve current needs and utilizing the best available building materials and techniques) can be found in each historical era. Despite gaps of years, decades, or even longer timespans, the modern world has generally always had a relatively fresh example of a planned new town or city. The United States has had a number. Washington, D. C., is perhaps the best known example of a city originally brought into existence and developed according to preconceived plans.

But most of America's towns and cities were once "new towns," planned or otherwise. It was the westward expansion of this country in the 1800s, and the resulting new towns, that provided Ebenezer Howard, an Englishman, with some of the inspiration for his remarkable book, *Garden Cities of To-Morrow*.[4] Lewis Mumford, in his introductory essay for the 1945 edition of Ebenezer Howard's book, states that although the work of a number of men was part of the basis for Howard's own beliefs, "no little stimulus came to him from his visit to America, where he had before him the constant spectacle of new communities being laid out every year on new land, and he was impressed by the possibilities of a fresh start."

Mumford points out facts that Howard understood but we are only now beginning to grasp.

> In treating rural and urban improvement as a single problem, Howard was far in advance of his age; and he was a better diagnostician of urban decay than many of our own contemporaries. *[It is interesting to note that Mumford wrote this in 1945.]* His Garden City was not only an attempt to relieve the congestion of the big city, and by so doing lower the land values and prepare the way for metropolitan reconstruction, it was equally an attempt to do away with that inevitable correlate of metropolitan congestion, the suburban dormitory, whose open plan and nearer access to the country are only temporary and whose lack of an industrial population and a working base make it one of the most unreal environments ever created for man . . .

Mumford also states that:

> In short, Howard attacked the whole problem of the city's development, not merely its physical growth but the interrelationship of urban functions within the community and the integration of urban and rural patterns, for the vitalizing of urban life on one hand and the intellectual and social improvement of rural life on the other.

Howard was directly involved in the development of Letchworth (founded 1903) and Welwyn Garden City (1919), both near London, as the practical realizations of his ideas.

Many of the post-World War II new towns built in Great Britain not surprisingly show a strong Garden City influence. Howard's concepts have influenced many other new communities in various areas of the world. And some earlier new communities influenced by Howard have in turn influenced those being built today.

For example, Howard's ideas directly influenced a most important new community started here in 1929—Radburn, New Jersey. Radburn was planned by Clarence Stein and Henry Wright as a complete Garden City. Although only part (two superblocks) were built by the City Housing Corporation in 1929-1933, because of the depression, Radburn has influenced new communities ranging from Greenbelt, Maryland (commenced in 1935 as a result of the Emergency Relief Appropriation Act and the National Industrial Recovery Act, 1935) to various types and sizes of planned new communities presently under construction in numerous countries. Two important concepts demonstrated at Radburn and now used in many well-planned communities are the separation of pedestrian and vehicular traffic and the grouping of houses to save land for local park and recreation areas.

Planned new communities—varying in purpose, size, and degree of completeness—are underway in so many nations that a list of them resembles a United Nations roll call. Among these are: Australia, Brazil, Canada, Denmark, Finland, France, West Germany, Great Britain, India, Israel, Italy, Japan, Mexico, The Netherlands, Norway, Pakistan, Poland, Portugal, Sweden, U.S.S.R., Venezuela, and Yugoslavia.

Useful Ideas from European New Communities

Many Americans have the attitude that anything "they" can do, we can do better. Others seem to think that nothing we do is right, and believe planning and development in most other industrialized nations is vastly superior.

Both are wrong. We have much to teach, but we also have much to learn. We can gain useful insights from new urban development wherever it is occurring—but that does not necessarily mean we can adopt just any interesting concept. Rather, we must look at what is being done in new community development in other countries, and *use* what we learn to meet our needs and our resources. Further, we should look at the little-known and unknown new communities as well as at those that have been well-publicized.

Sweden As an example of well-known new community development we might start with the satellite communities of Stockholm. Vallingby is the best-known Stockholm city district, but development of this type in the Stockholm area began with the Arsta center in 1954. The newest is Skarholmen, which opened late in 1968. In each of these communities, the core—a center for community activities as well as for shops—is surrounded by housing and is connected with the center of Stockholm

View of part of the shopping center in Skarkolmen, Stockholm's newest suburban district. Building in right background is a "hotel" for older people. A sports center is under construction, right center.

by a clean, attractive, and very efficient subway system. A major factor in the successful development of these communities was municipally owned land. Stockholm city planners now state that a major problem in planning future development is the lack of an adequate supply of municipal land.

Stockholm is not the only Swedish city to expand by building satellite communities. Gothenburg, a major port with a population of approximately 500,000, has several new housing districts (or satellite communities) wholly occupied, and others are under construction. All are connected with the commercial and industrial areas of Gothenburg by bus or tram service. Each includes day nurseries, kindergartens, schools with adjacent playgrounds and sports fields, shops, community amenities such as libraries and meeting rooms, and ample parking facilities for each house and apartment. The larger housing districts, such as Kortedala, 5 miles northeast of the center of Gothenburg, also include offices and small industries; most of the working people in this satellite community of about 30,000 have jobs elsewhere in the Gothenburg area. Gothenburg's planning is certainly not on a small scale—the city's planners in 1968 completed a general plan for a new satellite city which is expected to have a population of approximately 150,000 people before the year 2000!

Finland Helsinki, like Gothenburg, is a major Scandinavian port with a population of approximately 500,000 which also decided some time ago that further growth should be primarily in satellite communities. As the capital of Finland, and the largest city in the country, it attracts the majority of the people who leave rural areas. Helsinki is a handsome city; Alvar Aalto's plan for urban renewal of the city's heart, together with planned expansion in satellite communities, should ensure that it continues to be both handsome and active. Several satellite communities planned by the city government have been completed and others are in various stages of construction; all are largely dependent on the older areas of Helsinki for industrial and other nonservice-oriented jobs. In addition to the city-planned satellites there is Tapiola, the guiding star for many planners and new community developers throughout the world.

Only 6 miles west of Helsinki (across several bays and islands), Tapiola was planned and built by a private nonprofit enterprise, the Housing Foundation Asuntosaatio, which was created in 1951 by six large national organizations under the leadership of Heikki von Hertzen, a Helsinki lawyer with an idea, talent, and perseverance. Mr. von Hertzen, Managing Director of the Housing Foundation, has led the planning and administration of Tapiola from the initial concept, through the planning work of a team representing many disciplines, through competitions for planning and designing everything from new types of housing to neighborhood units and the city center, to construction of the entire development, the preservation of every tree that could possibly be saved (he only lost two to the bulldozers), and administration of the new community.

Tapiola was planned as a self-contained community where much of the working population will be able to be employed. High- and low-rise buildings have been combined in such fashion that they harmonize with each other and with their natural surroundings while they provide variety and give this small community a sense of "place" that is missing in most much larger new communities in the United States and abroad. Tapiola is today a town with about 16,000 people, and a long waiting list of would-be inhabitants. It is also the center for an area which now has about 35,000 people and is planned to have a maximum population of about 80,000. Because it is a center for an area larger than itself, Tapiola has a variety of shops and other facilities that a town of 16,000 could not support.

The Housing Foundation, Mr. von Hertzen, and his team, are already at work planning and developing other nearby new communities. The first inhabitants moved into one section of the Housing Foundation's second major new community—Espoo Bay—last autumn.

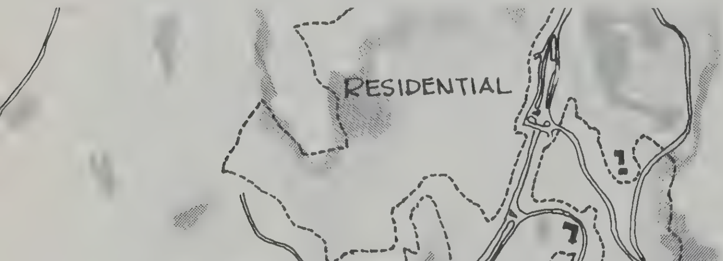
Planning has already commenced for building a new town, Porkkala-on-Sea, farther west in Uusimaa, the province in which Helsinki, Tapiola, and Espoo are located. Because there was no plan for the development of the region, and the Housing Foundation's team was well aware that expanded and new communities influence and are influenced by a very large area, the Foundation itself commissioned in December 1964 the preparation of a preliminary development plan for the entire Uusimaa Province.[5] This was carried out by a separate team that included experts in regional and master planning, urban design, population statistics, regional geography, harbor planning, traffic planning, sociology, education, architecture, public administration, and even climatology. Porkkala-on-Sea is the largest new community being planned by the Housing Foundation. It is unlikely that its construction will begin until work on Espoo Bay is well advanced. Lessons learned from the development of Tapiola and Espoo Bay, as well as from the Uusimaa Province regional study, should make this new community even more interesting than its predecessors.

Norway The results of expanding a small city by building planned satellite communities can be impressive. Bergen, a city of about 120,000 people in Norway, is building its own satellite of 25,000 in cooperation with private enterprise. Although Bergen has little lower-level land remaining between the mountains and the fjord on which it is located, there were a number of ways the city might have expanded. Buildings could have been built higher on the mountain slopes, the density of existing

Bergen, Norway, with its fjord and surrounding hills. Bergen's beauty probably would have been diminished if additional housing had been squeezed into the existing city boundary.

lowlands could have been increased, or part of the fjord could have been filled to create prime building sites. Instead, Bergen's decision-makers chose to have a tunnel bored through a mountain and to build a totally new community called Fyllingsdalen, in the valley on the other side. As a result, they have saved their beautiful city and have, as a bonus, a very attractive satellite.

Fyllingsdalen is a planned community with separation of pedestrian and vehicular traffic. A bus system connects areas within the new community and links it with Bergen. There is variety in housing prices and in housing types, which includes high-, middle-, and low-rise apartment buildings of various shapes, terrace (or row) houses in short groups, and single-family detached houses. All are sited to provide maximum views of mountains, the valley, or nearby fjords. Fyllingsdalen includes neighborhood convenience stores as well as a town center; schools; a church and even a cemetery; provision for some employment in light industry and offices; and recreation areas, some conveniently located for even the smallest children to play just outside their homes, and others within easy and safe walking distance on the pedestrian paths. Perhaps the most impressive fact about Fyllingsdalen is that its planning and its development are the result of the combined efforts and investment by the public (primarily the city of Bergen) and by private enterprise. Spokesmen for both the public and the private sectors have stated that both planning and development have required more time, because the two were working together, but they agree that the results were well worth the extra time and effort. [Editor's note: Bergen's achievement, one of the most significant in recent years, is virtually unknown even in Norway. Miss Davis is, as far as we know, the first American planner to visit Fyllingsdalen and to report on its development.]



Plan of Fyllingsdalen, Bergen's new satellite community for 25,000. Notice the ample provision of open space within the community and the surrounding mountains.

The Netherlands In the densely developed western part of The Netherlands, the city of The Hague, after World War II, built a number of new residential districts within its boundaries. Hemmed in on three sides by other municipalities, and on the fourth by the North Sea, this seat of national government (Amsterdam is the capital), is in part solving its expansion problems by working with a nearby small town to develop a satellite community. The old town of Zoetermeer (1963 population 10,033) is only 9 miles from The Hague, but is separated from it by the small municipalities of Rijswijk and Voorburg, and an area of good-quality agricultural land identified in the *Second Report on Physical Planning in The Netherlands*[6] as an area to be kept in open-space use. It is expected that this small town will be developed to accommodate approximately 70,000 people by 1980 and ultimately, 100,000 people! Plans for development include provision for some industry, offices, and shops, as well as housing and needed community facilities and services. Zoetermeer is connected with The Hague by railroad and bus lines, and there is discussion of the possibility of linking the city with its satellite town by additional mass transit—perhaps monorail.

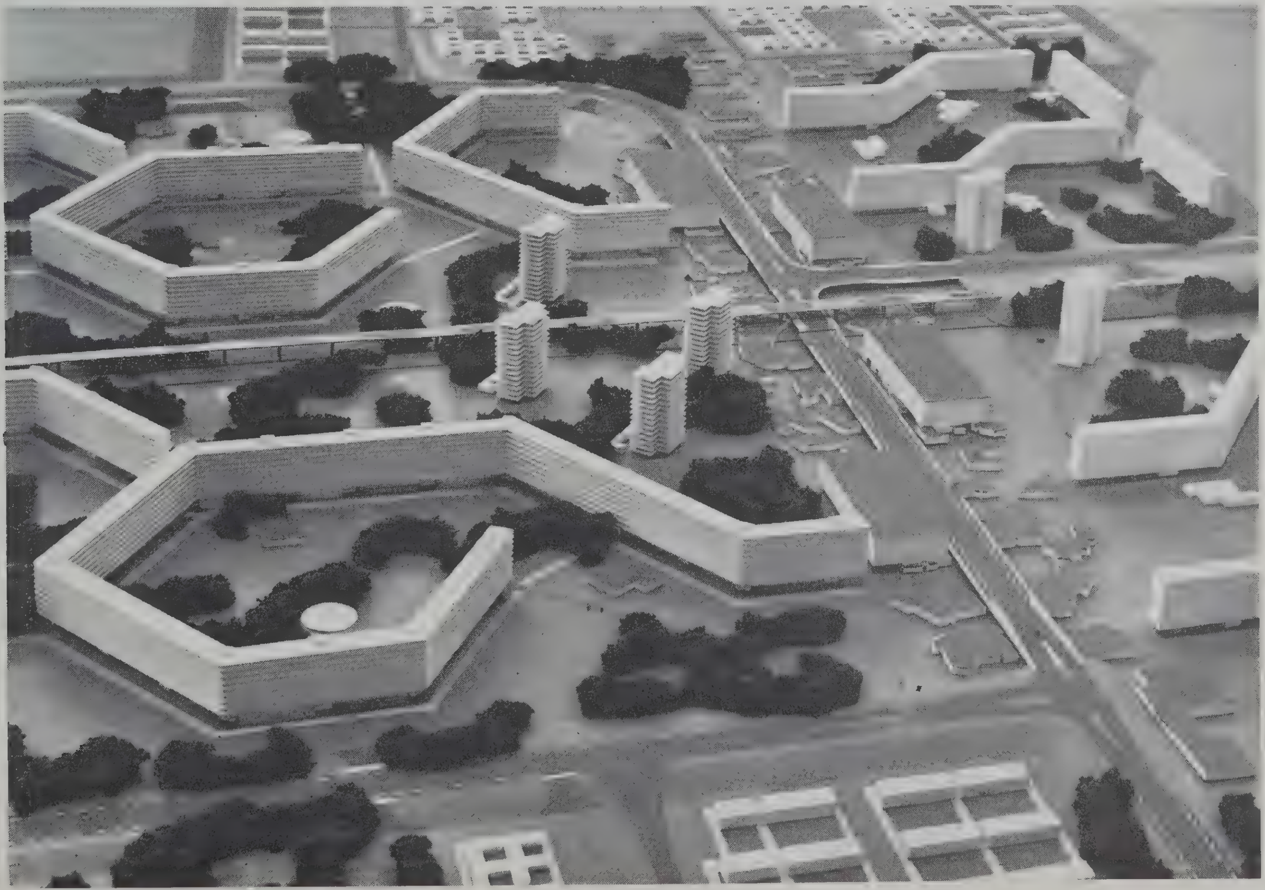
The development of Amsterdam has been carefully planned since the 17th century. Since World War II, the General Extension Plan for Amsterdam (which was completed in 1935) has been implemented and additional plans have been made. The main expansion has been on the western side of the city. Six "garden suburbs" were built around Sloterplas, a large artificial lake created by excavating sand to get fill for raising the ground level in Amsterdam West. These are, in chronological order, Slotermeer, Geuzenveld, Slotervaart, Osdorp, and Overtoomse Veld. More than 140,000 people live in this new area.

More recently, three new communities have been commenced north of Amsterdam. Nieuwendam-Noord, Buikslotermeer, and Buiksloterbanne are in relatively early stages of development. They are expected to house more than 50,000 people when completed. Altogether, Amsterdam North is planned to become a city-sector, housing about 100,000 people.

On the southern side of Amsterdam, the city is constructing another new community—Buitenveldert—which already has more than 30,000 people. Nearby, the municipality of Amstelveen has greatly expanded and will accommodate more of Amsterdam's overspill population.

Southeast of Amsterdam, on land acquired by the city in 1966, the newest expansion project is underway. Bijlmermeer is quite different from the other new communities. Its master plan calls for megastructures to house many of the anticipated

Bijlmermeer is Amsterdam's newest expansion area. Much of the community's population will live in megastructures, such as shown in this model. Pedestrian and vehicular traffic will be completely separated.



110,000 people. Traffic problems are to be solved by a system having through traffic on elevated highways, local traffic on semi-elevated roads, and both bicycle paths and footpaths at surface level with no intersections to cross. Almost all parking is to be in garages, thus freeing the space between buildings for use as parks and recreation areas.

For long-range planning, it is difficult to match the Dutch. They are in the process of significantly enlarging their total land area by making polders—new land areas—on what was once the bottom of the Zuider Zee. With the completion in 1932 of an enclosing dam in the northern part of the Zuider Zee, the Ijssellmeer (or Ijssel lake) was formed. Gradually, the water in this lake, fed by a branch of the Rhine River, has become fresh. Three new polders have been reclaimed from the sea by surrounding each area with a dike and pumping the water out. Two more polders are being prepared.

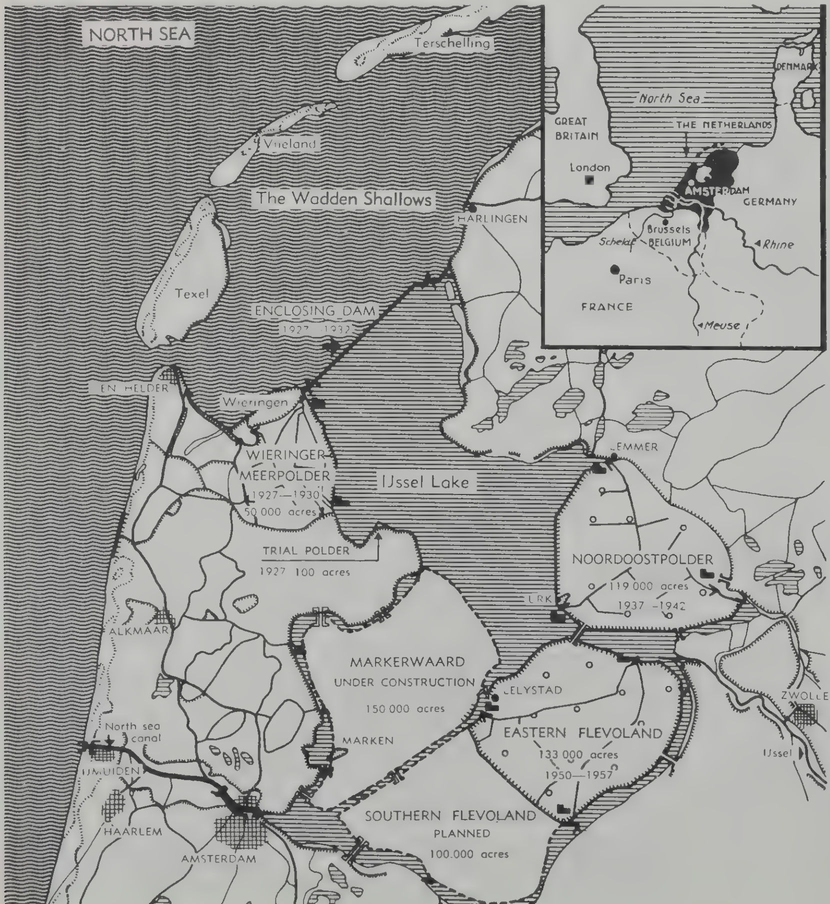
The Wieringermeer Polder (49,000 acres) was diked and drained while the great barrier dam was being constructed. It has four villages which are now considered quite old-fashioned. The North East Polder (120,000 acres) is the site of a pleasant new town (Emmeloord) and 10 new villages (Bant, Creil, Ens, Espel, Kraggenburg, Luttelgeest, Marknesse, Nagele, Rutten, and Tollebeek), each with a different character; all have been built since 1942 when the land became dry. On the Eastern Flevoland polder (135,000 acres, dry in 1957), the town of Dronten and two villages are under construction; also, a few buildings exist at Lelystad—designated to be the major city in the area when the new Ijsselmeer polders have been completed. The Markerwaard (150,000 acres) and Southern Flevoland (100,000 acres) polders are not yet ready for development. Although land in the new polders is primarily for agricultural use, special sites are saved for industry and for recreation uses, and ample space is being reserved for new communities.

The Need for New Communities in the United States

Many of the legal, financial, and social institutions needed for the development of a number of new or expanded communities in the United States already exist. However, they have not yet been focused on the opportunity to provide additional, alternative places for Americans to live. Today most of the various "new communities" under construction fall far short of what they could—and should—be.

In most instances, the American "new communities" are little more than bedroom suburbs, with perhaps a few more facilities than the subdivisions

Five areas of new land have been created by diking and draining parts of the Zuider Zee. Plans call for Lelystad (named for the engineer whose vision led to this gigantic reclamation project) to be the major city in the new polders; its population probably will exceed 100,000 before the year 2000.



built just after World War II. Most of the new American communities—in spite of their advertising claims—lack much of the farsighted planning and innovation which characterize their European counterparts. Most lack:

- The careful consideration of human needs (social and economic) within each town, city, and region that is provided in the Dutch planning programs;
- The cooperation and combined effort of city agencies and private enterprise to plan and build satellite communities in Norway;
- The site selection based on regional planning, provision of an economic base, and housing for lower income families that are characteristic of Britain's new towns;
- The community centers and transportation systems of satellite communities in Sweden; and
- The site planning, preservation of natural beauty, and architectural grace of Finland's new communities.

True, some newly developed communities in the United States offer some of these advantages. But in too many instances the needed facilities, services, and amenities have not been provided. Why should this situation be allowed to continue?

The American public subsidizes these developments in many ways. The Federal government, with tax money, guarantees mortgages on houses, helps small businesses get started, and aids in planning, among other things. Federal, State, and county roads provide access to and from nearby cities. Federal aid helps provide educational and medical facilities. Local government aid also is provided for the schools—and generally for fire and police protection, and water supply and sewage treatment systems as well.

We cannot afford to continue growing in a haphazard way. The lack of goals and policies (the framework for decisions) does not stop development, but does:

- Encourage conflict in development;
- Result in constantly lowering the quality of America's environment;
- Cost more money—today—to install and service buildings, streets, etc., that all too often are built in the wrong place or at the wrong time;
- And, worst of all, continuing growth in this unplanned, unordered manner precludes many opportunities for the future.

Failing to make a decision is, in fact, a decision to encourage haphazard growth.

It is obvious that policies and programs are needed for building new communities of various sizes and degrees of completeness. And the opportunities to build "new cities" by expanding existing small towns and cities should be utilized. The question is: How much more time, land, human effort, and money will we waste before having in each State a policy, plan, and program for building new and expanded communities?

New communities will be built. Where they will be built, how successful they will be in terms of their location, their impact on the surrounding area, their links to other communities, and their social and economic viability depend upon the choices made today.

We have the natural resources, the money, the talent, the capability, the technology—and we have the need. We *must* build America better. ☐

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Perceptional Aspects of the Learning Space

by
Leland G. Shaw

It can be said that the process of education is directly related to the perceptual aspects of the physical surroundings. The environment in which a person or object is viewed, the ease of viewing, and ability to concentrate while viewing without distraction, are all perceptual aspects which affect the learning process.

Creative architects have long claimed that a building and its interior spaces should do more than just provide its users with physical comfort and beauty. The way a space is physically shaped, hence perceived, can greatly affect the efficient use of the space. The word space is used here to refer to an interior volume as established by its physical boundaries created by space, color, texture, and perhaps light and sound.

The educational process is in some way affected by the space in which it operates. The student's interest, attention, and ability to concentrate are modified by the environmental space he occupies. Therefore it is valid to assume that by changing the space with color, texture, light, and shape, the student's learning powers will be in some way changed.

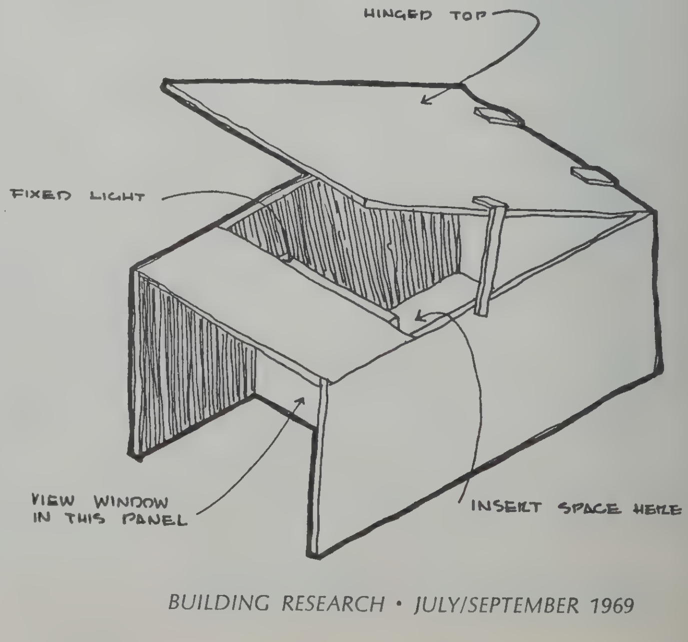
This research reported herein was designed to investigate a portion of this hypothesis through the use of a series of flexible study models which would test three-dimensional visual attention and discrimination reactions of elementary school children to particular spaces. For example, one of these test spaces has the walls and ceilings converging to a single plane. Will it be easier for the subject to find an object placed at the point of convergence, identify it, and concentrate upon it for longer periods of time than in the normal space situation? What are reactions of the subject to objects not placed at the point of convergence? The results of the work should lead to a better understanding of such questions and to many other related aspects of children's visual responses.

A great deal of work has been done using two-dimensional perception tests to study students' comprehension of certain figures (i.e., *"Developmental Test of Visual Perception"* by Marianne Frostig), but very little research has been conducted using three dimensional space.

From its inception this project has been treated as a pilot study, one which hopefully would have far-reaching implications and many avenues on which to concentrate further work. With this in mind, the study has been intentionally kept as free as possible, covering a wide range of space changes in order to establish rough initial data to be further developed and hypothesized as the work continues.

Test Box and Insert Spaces

In establishing the physical unit of the test, the initial problem was to design a model which would allow maximum flexibility during testing, minimum



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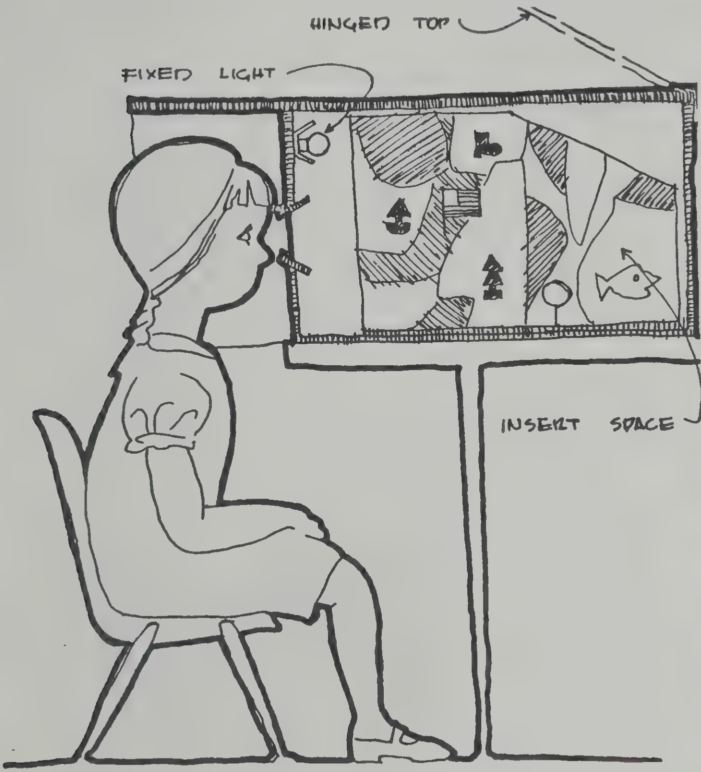
disturbance to the children being tested, require a minimum of time to change the space during the testing, and be moderate in cost. The decision was to construct a 3/8″ plywood frame box with a controlled light source, and a face-mask window for viewing the interior. This box would act as a frame into which lighter more flexible and temporary spaces would be inserted. The interior dimensions of the box were to be 18″ high, 22″ wide and 36″ long. These dimensions would provide a well proportioned space of maximum usable size in which to work.



Section through the test box showing test subject ready for observations.

The top of the box was hinged to allow the insertion of the specifically designed spaces. These insert spaces, somewhat smaller than the box frame, were constructed of corrugated cardboard and colored construction paper. Such materials provided light weight spaces which could be set into and removed easily from the plywood frame. This series of interior spaces was embellished with simple two and three-dimensional objects located in various positions. Objects, and pictures of objects familiar to children were chosen for ease of recognition. Each space insert had five three-dimensional objects and at least five two-dimensional pictures of objects located within its confines. On some of the more complex spaces additional two-dimensional figures were added to test visual attraction due to various locations. In addition, some spaces were designed to test the attraction of the wall surfaces. This was done by covering the wall surfaces with a collage containing cut-out figures.

Each two and three-dimensional object was repeated in at least three different insert spaces, in three locations. This was done to allow recognition of the difference between "object" and "placement pull."

It should be re-emphasized that these insert spaces were not designed on mathematical principles, nor were they to exactly simulate certain schoolroom situations. One series of space changes was intended to draw visual focus to a narrow plane through the successive use of a (1) sloping floor, (2) ceiling, and (3) the addition of intermediate partitions. While other comparisons between the various spaces will be discussed, the precise location of each element and the exact shape of the space was not of prime importance at this stage of test development. Instead, the principles behind each space design were considered the key factors.

Typical Space—The surfaces are covered with a collage of colored papers, and solid objects are scattered throughout.

The ideas for each space came initially from considerations of the educational process in a classroom. Continued discussion and evaluation have indicated that the work should also be considered in terms of the theoretical perception of objects in space as affected by the condition of the space. The results derived from these spaces will of course be fundamental to classroom perception. The possibility of a future test being developed using a full-scale space in which a person is placed and his perception tested using various full-scale space conditions is discussed later in the report. The results of the present work constitute a necessary initial step in the development of such spaces.

Method of Testing

The subjects (elementary school children) were usually tested in groups of two. It was found that this reduced the number of times the spaces in the box had to be changed, but did not break the continuity of the test. The testing procedure was to seat the subject in front of the box frame, with his face against the viewing window. The box light was off, and the contents of the box could not be seen. A switch located on the outside of the box allowed the investigator to control the light. The data collected consisted of responses to three questions each of which, in effect, became a task;

(1) The light was turned on and the subject was asked to describe what he saw. The observation was recorded by the investigator under Task #1 on the item sheet.

(2) When the subject stopped listing observed objects, he was asked to continue looking into the box. After approximately 15 seconds the subject was asked what object he was looking at. This was recorded under Task #2.

(3) Following the Second Task the subject was asked to continue to look for another 15 seconds, the light was then turned off, and he was asked to recall what he had seen. This was recorded under Task #3.

The space inserted was then removed, another inserted, and the process repeated. Two investigators were used to administer the test. One placed the space insert in the box frame and controlled the light, while the other recorded the responses of the subject.

The three task questions gave three types of data. From question number one the subject's immediate reaction to the space was obtained, the first object he listed being the one he was immediately attracted to, and so on. Question number two, asked when the subject had become initially familiar with all the objects in the space, determined what he had "locked on to" at that stage of viewing. The final question determined the objects that could be recalled by the subject after the visual stimulus had been removed.

A total of thirteen test spaces were used while the average time for testing one student was approximately 1 hour, or about 4½ minutes per space. With very young children, or exceptional children, with short powers of concentration the test was given 3 successive days for 20 minutes each day. With more mature children the test was broken into only two parts. All subjects saw the spaces in the same sequence.

Control Groups

The subjects involved in the testing program were students in attendance at P. K. Yonge Laboratory School, Gainesville, Florida, during the summer term of 1966. The pre-school through grade three group was selected because it was felt their conditioned reactions to the spaces would be minimal due to the lack of visual sophistication at this age.

The children involved in the tests included the following, listed according to the grade to be entered in the Fall of 1966:

A. Second grade	13
B. Third grade	6
Fourth grade	5
C. Kindergarten	4
D. Perception problem children	5

Students of normal or above average intelligence, found to have problems in perception which could impair their learning. They were enrolled in a special summer class, which attempted to strengthen and understand their perceptual problems.

TOTAL CHILDREN TESTED 34

	TASK 1	TASK 1	TASK 2	TASK 3	TASK 3
Box Number	Response 1	Response 1-4	Response 1	Response 1	Response 1-4
1	84	63	78	66	58
2	66	53	66	71	47
3	75	57	90	93	60
4	54	49	66	63	49
5	87	65	88	81	63
6	85	59	92	64	53
7	93	64	62	70	63
8	82	66	94	67	74
9	92	58	88	82	60
10	89	62	82	70	61
11	79	62	88	52	51
12	55	55	91	70	59
13	59	59	100	63	53
TOTAL	1000	772	1085	912	751

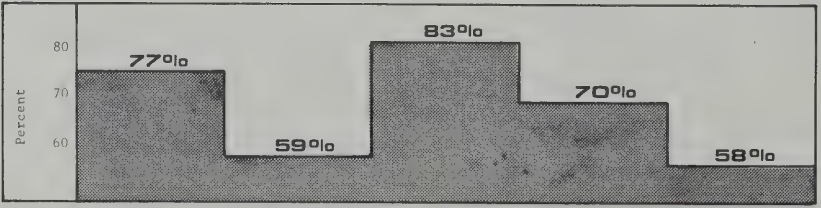
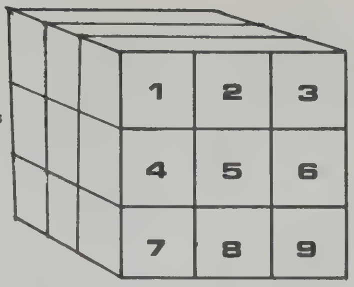


Figure 1. The percent of solid objects named for all spaces, task by task.

$$\frac{\text{Number of Prime Responses For the Quadrant}}{\text{Total Number of Prime Responses for all Quadrants}} = \text{Percent of Responses for the Quadrant}$$



Quadrant Location Diagram

Percent of Responses	Quadrant No. 1 4.29%	Quadrant No. 2 7.1%	Quadrant No. 3 10 %	
Front	2	0	0	2
Middle	1	5	3	9
Back	0	0	4	4
Percent of Responses	Quadrant No. 4 18.6%	Quadrant No. 5 17.1%	Quadrant No. 6 5.7%	
Front	0	0	0	0
Middle	1	1	2	4
Back	12	11	2	26
Percent of Responses	Quadrant No. 7 8.6%	Quadrant No. 8 5.7%	Quadrant No. 9 22.8%	
Front	0	0	0	0
Middle	4	3	4	11
Back	2	1	12	15

Front	2
Middle	24
Back	45

Figure 2. Percent of prime responses by quadrant for all three tasks.

Results

The principal objective of the study was to explore methods by which children's perception of enclosed space could be investigated. Because of the exploratory nature of the study, parametric analysis of the data was not conducted. The results utilize descriptive statistics for the analysis of the data.

There were four principal factors which were manipulated; these were:

(1) The type of object: solid or flat
(2) The importance of specific objects
(3) The position of objects in space, and
(4) The shape of the enclosed space.

The results of the study are presented in the order of these four factors. The following is a summary and generalization of detailed findings which are printed in the final research report of the project. Only some general trends will be mentioned here; detailed analysis would necessitate numerous charts, graphs, and a complete set of photos of the spaces.

1 **The type of object: solid or flat.** The results of the first analysis concerning whether solid or flat objects create the strongest visual pull can be seen in Figure 1. This chart summarizes the total percent of solid objects named for each task, and response group for all spaces. The results suggest that the children showed a clear preference for solid objects rather than for flat ones in all response and task categories.

It should be noted in Tasks 1 and 3 that the first response shows a distinctly stronger solid object pull, than the average of the first four responses totaled into one percentage. Only in three instances out of 39 did the solid object responses drop below 50% (49, 49, 47%) and all these were in the four-response summary. It is also interesting to note that in Task 2, the "lock on" task, the solid object response total is the highest (83%) of all the tasks.

This data would indicate that solid objects exert a strong visual pull, but also shows diminishing power as more responses are tabulated.

There seems to be no discernible relationship between the shape of the spaces and the number of solid objects named due probably to the high number of variables involved.

2 **The Importance of Specific Objects.** One of the influencing variables in the study was thought to be the interest value of specific objects. Some types of solid objects or pictures might catch a child's attention irrespective of its placement in any given space.

Responses were categorized in two ways: first, by the three objects (one per task) which were named most often in Response Number 1. Such responses were called "prime" responses; second, by the three objects (one per task) which were named most frequently within the first four responses each subject gave. Such objects were designated "principal" responses.

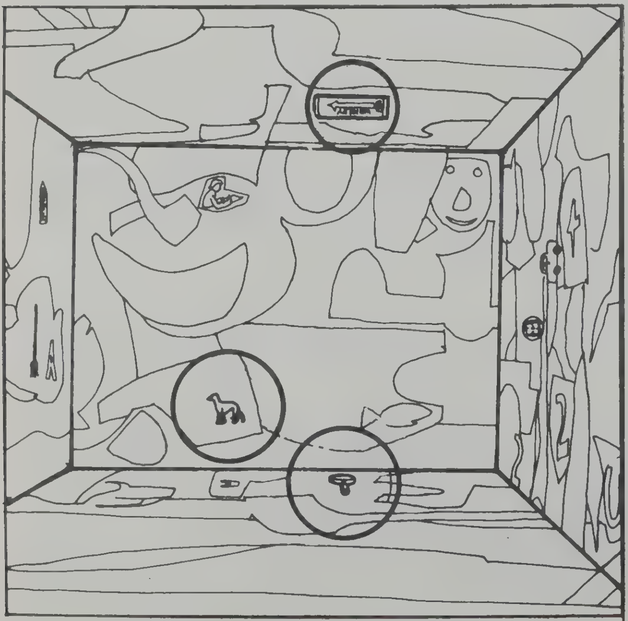
For each of the three tasks in this study, a frequency count was made for each stimulus object named as a prime or principal response. It is therefore possible for an object to be a principal response up to 15 times and a prime response up to 9 times. Because "truck" and "car" were confused in recording, these responses are of no value in this analysis.

Two general statements can be made. The commonality among the stronger response objects appears to be due to the familiarity a child would have with such objects (i.e., horse, sucker, bell, and bubble gum). However, the more important implication of the results for prime objects would seem to be that the interest value of a particular object can be so strong as to exceed or negate the influence of the other factors investigated in this study. That is, children tend to be attracted to important objects irrespective of their position in space.

3 **The Location of objects in enclosed space.** In order to facilitate the analysis of data on the location of objects in space, the interior space of the box was visually divided into three sections: front, middle and back. Such a mapping of the interiors of the boxes provides a 27 cell matrix by which an object's location in a given box can be described. This can be seen in the upper right part of Figure 2.

Figure 2 shows the locations of the objects named most frequently for all the tasks and within all the spaces. The grand totals shown in the lower right-hand corner of Figure 2 indicate that objects located at the back of the boxes were named prime responses considerably more often than objects in the front or middle of the boxes. Forty-five times, objects which were in the back of the boxes were named prime responses as compared to 24 times for middle depth-located objects, and only two times for foreground-located objects.

Test Space No. 7



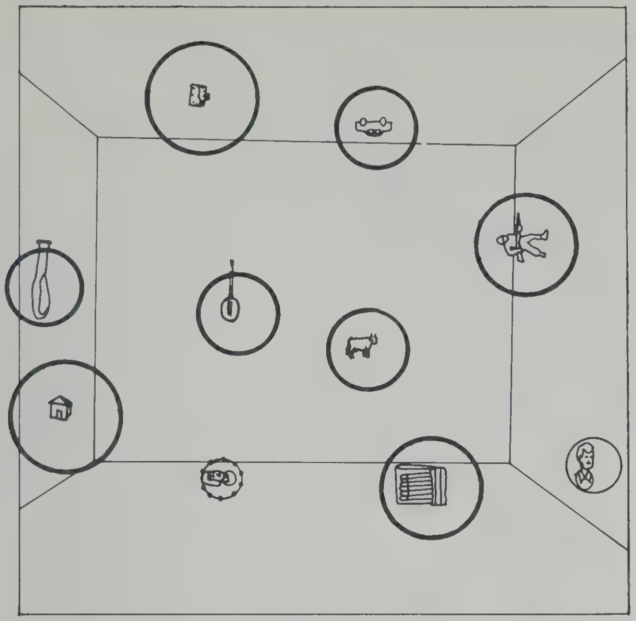
4 **The Shape of the enclosed space.** This final analysis, while probably the most interesting to people dealing with visual design, is the most difficult to quantify. A very complex system of identifying and using the first three prime and principal responses for each task was developed for analysis. These responses were transferred to individual sheets of clear plastic (one per task) so they could be laid over the photographs of the spaces, singly or in series, for observation. The final research report contains a complete set of 13 photographs of the spaces and three plastic overlays per photograph. Here, three diagrams—facsimiles of the spaces and key responses—have been included for discussion.

A clear comparison can be made between spaces #7 and #11. Both are rectangular. Space #7 has its surfaces covered with a multi-colored collage of cut paper. It creates a confused, disordered space. In this confusion there seems to be three areas of calm; three objects which draw the subjects' attention. These three objects (dog, sucker, and gum) were the principal and prime responses for all tasks.

Space #11 was a plain white space. In this very simple space no single object could long remain the center of attention because all objects were clearly visible. Eight objects (boy, soldier, car, sucker, girl, balloon, matches, and cow) were all prime and/or principal responses to the tasks. This would seem to indicate that a child will "lock on" to objects in a chaotic environment for visual understanding, but will visually roam free in a simple environment he fully comprehends.

Space #4 would seem to reinforce this idea. The back wall of the rectangular space is covered with a collage of figures cut from a magazine. The other four surfaces are plain. Six objects were key responses, and five of these lay on the plain surfaces (match book, truck, girl, watch, and doll). Only the clothes pin which lay on the collage counted in the prime and principal response total and it only once.

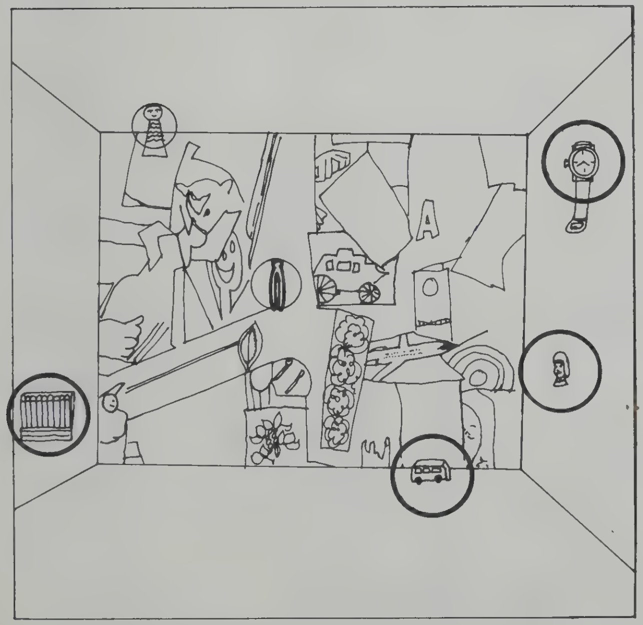
Spaces which slanted in some manner to a line or plane always created a strong object response at the plane of convergence. When one intermediate plane was added the interest began to be drawn away from the convergence plane, and when 4 planes were added, it all but destroyed the convergence effect. The intermediate planes, perpendicular to the eye, became the strong response planes.



Test Space No. 11

When the space is so shaped as to call attention to a particular object, that object becomes a prime response object. Certain spaces had a horse set in a niche in the upper right corner. Even though a soldier was in a prime response position, the horse was a prime response 4 out of 5 times. Another space called attention to a truck by making colored triangles of paper converge on it. It was the only object in the space to be a prime and principal response 5 of 5 times. Another space had two large red circles placed on the walls of the space and objects placed on them. Even though these circles were not placed in a commanding visual position they were both prime and principal responses 5 of 5 times.

Test Space No. 4



Conclusion

This pilot study has provided a significant amount of information related to how children see objects in various space situations. As is true in all pilot studies, many complex problems were encountered which may or may not affect the accuracy of the findings. The exact method of testing, the shaping of the spaces, the selection of the number of variables in the spaces, and the method of recording the child's reactions, may all be altered to improve the accuracy of the work. A tremendous amount of valuable testing experience was gained during the pilot study which should eliminate wasted effort and improve the accuracy of succeeding studies.

With this background, a second phase, based upon some of the major findings of the pilot study, is now being undertaken. It seems apparent that the number of spaces tested was excessive. Six to eight spaces will be used in phase 2. Each space is being increased from 22″ high x 24″ wide x 36″ deep to approximately 8′0″ high x 6′0″ wide x 8′0″ deep. This size allows the test subject to actually experience the physical properties of the space. Recall will be tested and at least one of the variables will be a teacher. Fewer objects will be placed in the spaces and the method of selection of the object will be reconsidered to eliminate as much as possible specific "object pull." Larger numbers of students will be tested and an audio and visual recording will be made of each child while being tested. This will allow the researchers to observe the child's responses several times at their convenience. Finally, the spaces will be shaped so as to relate to each other, each space altering one aspect of a controlled series. This series will be the change of a space from a single rectangle to a space where all planes slant to a single surface and past that to a complete breakdown of traditional spatial order terminating in a non-geometric curvilinear space.

The purpose of this research has been to work toward the development of a learning space shaped to maximize the effectiveness of the teaching method. Although few definitive answers resulted, the results have pointed the way to future explorations. □

Construction Without Seasonal Fluctuations

by
Jan Wittrock

The aim of this study has been to discover means of reducing seasonal fluctuations in employment and production in the construction industry.

Before any measures are taken to compensate for seasonal unemployment or fluctuations in employment, their objective must be determined: in other words, how far can seasonal unemployment be reduced. In order to answer this question, more must be known about the size and character of this type of unemployment than is at present possible on the basis of available statistics.

In most international publications, statistics are based on unemployment among insured workers. However, the coverage of the various national insurance schemes, the definition of construction workers, the conditions on which benefits are granted and consequently the extent to which unemployed workers register, vary from country to country. Where labour force sample surveys are available, they might often provide a more overall picture of unemployment, which can be compared from country to country.

More accurate statistics could be obtained by counting the number of man-hours actually consumed rather than by counting the number of employed or unemployed construction workers (the general practice). In this connection, I should like to draw attention to the Tenth International Conference of Labour Statisticians, held in Geneva in 1962, when the question of statistics on hours of work was discussed. The conference recommended that quarterly statistics should also be compiled for the construction industry.

Seasonal Employment

In addition to data on the seasonal decline, more detailed information on the nature of seasonal unemployment in each country is also necessary. Does it mainly consist of short-term unemployment caused by temporary stoppages and is this unemployment on such a scale as to motivate measures to combat it? Should all the unskilled workers who find employment in the construction industry during the summer be regarded as construction workers? If not, by how much will this reduce seasonal unemployment in the construction industry? If the construction activity can be evenly distributed over the year, what effect will this have on the employment prospects of unskilled labour, and will it be possible to find other jobs for those who can no longer except employment in the construction industry or who can only take seasonal jobs? Is seasonal unemployment mainly a problem in firms below a certain size, or is it concentrated to certain regions or sectors, etc.? There are obviously a great number of questions to be answered before the extent to which the seasonal fluctuations could be eliminated in a given country can be gauged and the necessary measures decided upon. The seasonal decline may be primarily an economic problem, depending on loss of production and an excessive pressure on the construction industry in the summer. It is, therefore, only possible to examine the obstacles most commonly encountered and to suggest some measures by which a better seasonal balance could be created.

Site Preparation

One indispensible way of reducing temporary stoppages is to prepare sites for winter work. There will probably always be a few days in most years on which work has to be suspended, unless steps are taken which must be rejected on economic grounds. In most European countries, however, the number of these days could be greatly reduced if simple measures were taken. It is not suggested that work should continue at all costs, but that it should continue in normal winter weather. A study of meteorological data over the last ten or twenty years should make it possible to determine what temperatures may normally be expected in each country.

Bad Weather Compensation

Most of the systems of bad weather compensation are not designed to interest employers in

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avoiding temporary stoppages during the winter. They would, therefore, seem to be due for review in the light of present requirements. More information about winter stoppages in terms of lost production, and the types of firms and categories of workers mainly affected by them, would be useful. It should be possible, to encourage building enterprises to introduce measures that enable work to continue without stoppage in normal winters. In Germany binding regulations to this effect are under consideration. The problem of small firms could be solved in some countries in the same way as in France, i.e. by excluding them from the system and obliging them to compensate their workers themselves in case of temporary stoppages. Since these firms are usually mainly active in the maintenance and repairs sector, they should be able to arrange for indoor work during the winter.

In countries with bad weather funds, the pay-roll costs of employers drawing on the fund only in extreme cases could be considerably reduced if they were entitled to a corresponding reimbursement of the contributions paid into the fund. This may make it necessary to increase contributions from other firms, but there is no reason why employers who take precautions to keep their men at work should help inefficient firms to finance their stoppages. The only danger is that they might then revert to the old order of seasonal lay-offs at the beginning of the winter. In view of the present labour shortage, however, the trade unions should be able to exert effective pressure on such firms by advising their members only to work for firms offering year-round employment. The system of guaranteed weekly wages is urged as an alternative technique because it automatically stimulates employers to find ways of continuing production and reducing lost time.

Conglomerates

In most European countries the majority of construction enterprises are small and moreover, often highly specialized. Such enterprises are more vulnerable to both cyclical and seasonal fluctuations owing to their limited field of activity and small financial resources. The formation of working units of enterprises active in the same geographical area or field of activity has, therefore, been recommended in several countries, although only moderate success has been encountered so far.

The main objection to this solution seems to be that it involves a certain loss of independence. However, the advantages appear to be so great that everything should be done to promote the formation of such units. Recommendations and information may contribute to reducing the resistance to this solution, but will require much time before tangible results are obtained. A most important measure to this end, which would also promote winter building generally, would be to force all employers, irrespective of the size of their firm, to observe legal provisions concerning workmen's

Number of unemployed in the construction industry 1957–1967.

	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Belgium	9,723	11,375	12,013	10,115	10,352	13,980	27,526	10,928	18,125	13,574	715
France	2,717	4,836	11,487	12,305	8,214	5,289	5,023	4,808	8,253	11,252	15,655
Italy	..	..	221,000	162,000	116,000	88,000	76,000	95,000	157,000	159,000	..
Yugoslavia	25,722	31,189	26,468	29,916	46,346	43,239	30,613	28,767	35,848	39,806	..
Canada	43,643	54,798	48,457	58,124	51,966	45,121	44,282	38,300	30,479	52,052	..
Netherlands	6,965	14,233	8,781	4,935	3,042	2,334	2,735	2,826	4,707	9,131	27,258
Norway	6,532	9,137	8,416	7,166	5,349	5,574	6,443	5,416	4,802	..	..
United Kingdom	46,728	62,946	73,936	55,125	50,110	73,899	118,142	60,721	53,829	60,150	93,907
Western Germany	169,816	200,566	127,330	53,057	27,536	15,123	18,917	15,509	14,955	14,893	28,308
Austria	23,815	25,485	22,844	16,845	12,909	14,540	16,319	14,182	13,124	10,813	12,883

Unemployment in the construction industry (index 1958=100).

	1958 1)	1957	1959	1960	1961	1962	1963	1964	1965	1966
Belgium	33,2	76	106	98	84	106	184	83	..	..
Denmark	24,3	103	60	45	41	55	55	34	31	35
Eire	15,5	109	87	68	57	54	59	56	53	59
France	4,8	56	238	254	170	109	104	100	171	..
Yugoslavia	31,2	83	85	96	149	139	99	92	115	128
Netherlands	14,2	49	62	35	21	16	19	20	33	64
Norway	9,1	72	92	78	59	61	71	59	53	..
Switzerland	1,4	79	100	66	32	32	57	10	12	13
Spain	18,0	104	96	160	168	100	100	167	173	144
United Kingdom	62,9	74	100	75	68	100	160	82	73	81
Sweden	13,8	84	78	63	58	63	68	53	55	75
United States	543,0	68	89	89	104	89	88	75	70	55
Western Germany	200,6	85	63	27	13	100	125	103	99	..
Austria	25,5	93	90	66	51	57	64	56	51	42

1) In thousands.

huts, etc.; the investments required would probably make many small employers prepared to sacrifice a little independence rather than be squeezed out of the market.

Winter Costs

There is no doubt that the main obstacle to winter construction is the assumed increase in costs for winter work (winter measures and lower productivity). What these costs amount to in different countries is not yet clear. Some investigations have been made but are either old or incomplete. It is impossible to make international comparisons based on different types of buildings, constructed under different conditions with different materials, methods and winter precautions. Moreover, certain items, e.g. clothing, meals, hot drinks, etc., are included in the additional winter costs in some countries but are not regarded as winter measures in others. In the latter countries, only heating facilities, and—on big sites—canteens, are normally provided; clothing and meals are not regarded as winter measures since the workers have special working clothes and always a hot meal at midday.

A more systematic analysis should make it possible to determine the costs of winter construction with greater accuracy and would show which types of work should be avoided. If the cost of certain operations such as concreting, bricklaying, etc., at different temperatures, supplemented by information on the methods used and the protective measures taken, were available, reasonably reliable international comparisons would be possible. We are aware that cost analyses of this type involve considerable work; however, many major contractors have already compiled such data for their own use. It is, therefore, suggested that an inquiry into the possibilities of obtaining internationally comparable data on additional winter costs be made.

The assumed additional costs for winter construction are generally expressed as a certain percentage of summer costs, but these percentages not being related to any specific project, often tend to exaggerate the actual costs to the owner and have a discouraging effect. For instance, figures relating to certain social housing projects will not show the additional costs for residential buildings rented at market prices. Finally, when deciding whether winter construction should be considered or not, it is essential to weigh the additional costs of winter construction against the cost of suspending work, together with the profits which may be expected from earlier completion. This point should receive more attention than is now generally the case so far as informing the public is concerned.

Although, when all the factors are taken into account, winter construction may frequently result in a net profit, traditional thinking is still so deeply rooted in most countries that some form of subsidy may be necessary, at least for the time being. Naturally, the extent and form of winter subsidies must be decided according to the situation in each country; in some countries subsidies for social housing and other projects expected to yield no profits, or only marginal ones will perhaps suffice.

Contractor Subsidies

Another question arising in this connection is whether it is better to subsidize the owner or the contractors. If it is decided that subsidies should be granted for certain types of projects only, subsidizing the owner is the obvious choice. The main disadvantage of this form of subsidy is that it will, as a rule, have to be limited to cover the additional costs of winter building on projects where no profits are expected, and will therefore generally fail to stimulate demand. Experience has also shown that such subsidies are unlikely to yield the desired results and must be supplemented by other means —or rather they should be used as a supplement to other measures. Subsidies to the contractor have the advantage of making the construction industry more interested in winter work and should generally stimulate demand by reducing or eliminating the additional costs. Subsidies to the contractors also seem to offer a better guarantee that they are actually used for the purpose intended, since they can be related to the number of workers at work under specific climate conditions. Subsidies can be made contingent upon effective action to avert seasonal slack.

This kind of subsidy implies, of course, that all types of projects are indirectly subsidized, irrespective of the owner. However, it will generally fail to interest small contractors and will above all stimulate demand in the profit-making sector. Since the additional costs are relatively higher for small projects than for big projects, contractors may also hesitate to undertake such projects, even if subsidies are granted only for projects above a certain size, as long as other contracts are available. This could perhaps be avoided by taking the size of the project into account when determining the size of the subsidy. This should not be too difficult if a system of the type in force in the Netherlands is adopted, where such factors as the type of work and working conditions are already taken into account. But whether the contractor or the project is subsidized or not, special measures will generally be needed in order to influence small enterprises and owners expecting no advantage from earlier completion.

In countries where winter construction is new and the majority of firms small, low-interest loans will probably be required in order to enable these firms to equip themselves for winter work. Though such aid should, in principle, only be granted for winter equipment, the fact that in many countries the social arrangements for the workers are still far from satisfactory may make it necessary to include other equipment under this heading during an initial period. Some form of guarantee that the applicants are seriously trying to include winter construction in their activity and are not merely using this opportunity to improve general conditions on their sites may be required in order to avoid abuse.

The workers must have special winter clothing and in countries where interest in winter work is new, they maintain that it is the employer's duty to provide it. As the latter will naturally include this item in the additional winter costs, a better solution would be to give the workers special loans or grants. This could be done by means of the unemployment insurance scheme, as in Germany, or by means of the bad weather compensation funds, where appropriate.

Buyer Subsidies

Prospective home owners no doubt constitute the largest group of owners who can expect no advantages from winter work. Even if they can get their additional costs covered, they generally prefer to wait until the summer. Their resistance to winter construction is mostly ascribed to the deeply rooted conviction that winter-built houses are of inferior quality. It is difficult to say how far this is true, but the Canadian subsidy for winter-built houses seems to prove that fairly small economic advantage can make them change their attitude to winter construction.

Most home owners' great problem is to find the capital required to fill the gap between the costs covered by mortgages and the total costs. In view of constantly rising buildings costs, many might even be prepared to accept the higher costs of winter-built houses, if a subsidy enabled them to finish their house a year or two in advance of schedule. As this subsidy, if it were to act as an incentive, would have to be higher than the additional costs, the cheapest solution seems to be a subsidy which would contribute to financing the first instalment, supplemented by a government mortgage covering the winter costs, since they are comparatively high for small projects. An excellent solution to the problem is to build several houses in a group and to spread the additional costs for the winter-built houses over the whole project. However, this is generally only possible where houses are built for sale and the builder assumes financial responsibility.

Municipal Projects

Other projects for which it is generally considered necessary to grant a subsidy covering the additional costs incurred by winter work are social housing and, in certain cases, municipal projects, particularly in financially weak municipalities. If such a subsidy is made available, it should be possible to require that all projects of a certain size for which government grants or loans are obtained should be planned for maximum winter employment.

In view of the importance of the public sector and the government supported private sector, much would be achieved if such projects could, as far as possible, be planned for winter work. In the first place, governments should be able to induce all government authorities and agencies to plan their projects (including maintenance and repairs) to ensure maximum winter employment; in this way they would set an example to other sectors before resorting to compulsory measures.

Although directives have been issued in several countries to government authorities to plan part of their projects for winter work, the results have often been far from satisfactory. The Norwegian system, which obliges government authorities to submit an employment plan together with their budgetary estimates, seems to be a good solution to this problem. As regards maintenance and repairs, the Danish system requiring such work to be carried out during the slack season, if this is technically possible, should yield the best results.

Governments could influence local authorities which receive government loans and grants by making the continuation of work during the winter a condition for such aid. This could be supplemented by a winter subsidy (e.g. graduated as in Austria and Norway) as an incentive to local authorities to plan their projects for maximum winter employment. Similar efforts should be made to influence other government-subsidy projects, e.g. clauses forbidding the interruption of work during the winter or requiring that work should be started between certain dates. To makes these clauses more effective, certain minimum winter precautions to ensure that work can continue down to a certain temperature should be required.

Public Awareness

Builders will naturally hesitate to invest in winter equipment, unless they can expect their costs to be covered. Therefore, demand should be stimulated by informing the public of the advantages and possibilities of winter construction. Though numerous reports and publications have been issued and lectures and discussions have been arranged in many countries, they have generally been of a technical nature and aimed only at the building trade. The best way of informing the public is by radio, television, and newspapers. Information of too theoretical a nature will also fail to reach many builders, particularly the small ones.

For practical use easily understood instructions are fundamental. The United Kingdom has used television, and films to reach as many builders as possible. The films, in particular, are informal, i.e. technically sound advice given in a non-theoretical way. These films have been lent to some other countries.

Industrialized Building

Industrialized building methods greatly facilitate winter work. The utilization of prefabricated components eliminates many of the most expensive winter measures. Such building methods also facilitate the employment of older workers since many heavy and tiresome operations are removed. All efforts to promote industrialized building will, therefore, contribute to the seasonal stabilization of the construction industry.

Planning and Coordination

Better planning and coordination at all levels is essential. Much time is still lost and many unnecessary costs incurred because plans—from town plans to working drawings—are not ready, municipal works not started in time, site work badly coordinated and credits not available. For this purpose, the first measures should be to adopt long-term construction programmes for public work, and also for private projects for which government loans or subsidies are granted. Furthermore these programmes would enable the construction industry to form a reasonably reliable opinion of expected demand and to plan its activity better.

If the seasonal pressure on the construction industry is to be eliminated, projects must be coordinated in such a way that the industry's resources can be fully utilized throughout the year. For this purpose, regional, or if necessary local building committees representing the parties concerned might be set up.

The tasks of these committees would be to follow developments on the regional building market, to advise owners and builders as to the availability of manpower and suitable timing of their projects, and to promote winter construction, e.g. by distributing pamphlets, by arranging meetings and discussions, etc. As the success of this voluntary planning will depend mainly on the local contacts of the members of the committee and the weight their recommendations carry, their districts should preferably not be too large.

The new Swedish system is a more comprehensive form of employment planning. It should, however, be observed that this system has developed out of the building control, has retained the administrative apparatus, and is based on certain legal powers. It has also been favoured both by the fact that employment planning is not new in Sweden, and by the system of government mortgages for residential buildings which enables the authorities to influence the majority in the housing sector.

The building industry is in need of dual stabilization—cyclical and seasonal. Here the interests of governments, employers and employees generally concur.

Experience has shown that it is very difficult to improvise measures against seasonal and cyclical fluctuations in the building industry, because practically every type of project requires extensive planning. Often three to five years may elapse between the beginning of planning and the start of work.

If it is desired to counteract a seasonal decline by increasing the amount of public building, this will only be possible if there are works at a stage of planning where work can begin at short notice or can be accelerated. Insofar as new projects are concerned, there must be a reserve of projects ready to be started, or so far advanced that they can be started within a couple of months at the most.

Data Collection and Forecasting

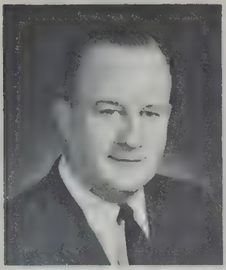
Some authority or organization should be responsible for following up and recording the various stages in the planning of all projects of importance to the building market. This follow-up would show the development of the building activity, the expected demand for labour and building capacity, and the need for such balance restoring measures as transfer of labour, training, and adjustment of starting times. This knowledge is also a prerequisite for estimating the scope of economic measures designed to stimulate the building activity without creating bottlenecks.

When estimating cyclical fluctuations, it is necessary to rely on the general economic forecasts made by various authorities and institutes. Experience shows that these measures may at times be taken too late, both in periods of economic decline and boom. The market then becomes unbalanced and it is necessary to resort to strong measures. If, for instance, it is found that public building has been stimulated too early, the balance can be restored by postponing new projects. If steps are taken too late, no such correctives are available. This is equally true in times of threatening inflationary pressure.

A system of forecasting employment at least a year ahead would be most valuable for seasonal stabilization. This forecast should be made by the authorities at least twice a year.

Public works for the unemployed, to stimulate mobility, etc., are primarily aimed at combating cyclical and structural unemployment, but this does not exclude the fact that they can be useful in combating seasonal unemployment too. This is, for instance, the case where seasonal unemployment is concentrated in certain regions, such as development areas, and regions where the climatic and geographical conditions or the structure of the building activity make it difficult to maintain year-round employment.

As unemployment is particularly high among unskilled workers, training courses for unemployed building workers may be expected to yield good results, particularly in view of the acute shortage of skilled workers in most countries. ☐



Industrial Building, Systems Design, and Water Pollution

by

Edward Willoughby

Within the last few years we have witnessed the culmination of centuries of fouling our own nest. We have denuded the land, contaminated the waters, and polluted our air supply. Our own personal surroundings are in many cases untenable and this has aroused the wrath of everyone.

Something must be done, so in our enlightened ways we are passing new laws and regulations, doling out grants for corrective work from the public coffers, creating overlapping bureaucratic regimes, doing much finger pointing and, in my opinion, accomplishing little. The Secretary of the Water Pollution Control Federation, Dr. Ralph E. Furman, recently reported to the House Subcommittee on Rivers and Harbors that the Federation's survey of waste water treatment equipment manufacturers revealed a decrease in contract awards with respect to water pollution control works. While the Federal government has, with much fanfare, authorized billions of dollars for pollution control work, the many other demands on the federal bankroll have resulted in actual expenditures for pollution control far less than authorized or desirable. The Federal government has, I believe, actually reduced the local communities to the status of poor relations who would rather wait for an inheritance than get out and work to solve their own problems.

Those of us engaged in building and building system design are in a rather unique position. We are as yet uncompromised with great promises of Federal aid and we have within our hands the ability to bring corrective action to over one-half of the Nation's water pollution problem. Persons such as ourselves, particularly when engaged in the field of industrial building and system design, have a great opportunity to achieve positive results quickly in the field of water pollution abatement. By working in close cooperation with our local health departments or other regulatory agencies, we can take immediate action on the problem. Our chief burden is that we must convince industrial builders that funds spent for water pollution abatement works are necessary, are being spent wisely and that the waste treatment systems proposed represent a careful economic evaluation of all possible alternatives.

Let me cite an example that should be of interest. This data I believe to be typical of most large metropolitan areas in the United States where the bulk of our water pollution problems are occurring.

Detroit Metropolitan Area

In 1964 the Department of Health, Education and Welfare made a pollution survey of the Detroit River and Lake Erie in an effort to determine the sources of and kinds of pollutants causing the degradation of these waters. Here I will consider three of the common pollution criteria measurements—oxygen demand, solids content and quantities of waste water—discussed in the HEW report.

First, the study revealed the oxygen demand of the effluent from the Detroit sewage plant was equal to the oxygen demand of the untreated sewage from a population of three million persons. Secondly, over 600,000 pounds of suspended solids and over 300,000 pounds of settleable solids were also discharged each day from this plant. As a third parameter, it was found that the total daily flow from the plant was approximately 540 million gallons per day. If the commonly used water consumption figure of 100 gallons per capita per day is applied, this flow was equal to the flow from a tributary population of 5,400,000 persons.

In addition to these loads on the river, shoreside industries were found to be contributing waste waters which had an oxygen demand equal to the oxygen demand of the wastes from a population of over 1,000,000 persons. These waters contained over 800,000 pounds of suspended solids of which almost 700,000 were settleable. A total daily flow

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of over 1.1 billion gallons originated from these industries. Such a flow might normally be expected from a population, again on a 100 gallons per capita per day basis, of over eleven million persons.

In addition to the foregoing, both the sewage plant and the industries discharged large quantities of iron, oils, phenols, and acids, all of which are not normally found in domestic sewage.

Figure 1 indicates what percentage of the flow, BOD (Biochemical Oxygen Demand), and solids load discharged into the Detroit River originated from industry and what part originated from the city sewage plant. This denotes the seriousness of the industrial waste problem. However, the situation becomes even more critical in the light of additional facts. The 1964 annual operating report of the Detroit Sewage Treatment and Disposal System notes the following data: (1) The system tributary population was claimed to be 2,800,000 persons. It was this fact that first seemed peculiar when compared with the 3,000,000 person oxygen demand population equivalent of the Health, Education and Welfare Department report. At first glance you might assume that the City of Detroit had no sewage treatment plant whatever. (2) BOD removals by the Detroit Sewage Treatment Plant averaged 2,976,000 pounds per day, which represented an average reduction of 37% of the applied load. This efficiency is about all that can be asked of a primary waste treatment plan of this type, and indicates that the applied load must have been about 8,000,000 pounds of BOD per day. Assuming a conservative, commonly used factor of 0.17 pounds of BOD per capita per day as a conversion factor, it becomes evident that the population equivalent of the connected load to the plant, based on oxygen demand, must have been in the neighborhood of 47,000,000 persons or about sixteen times the actual head count of the tributary population.

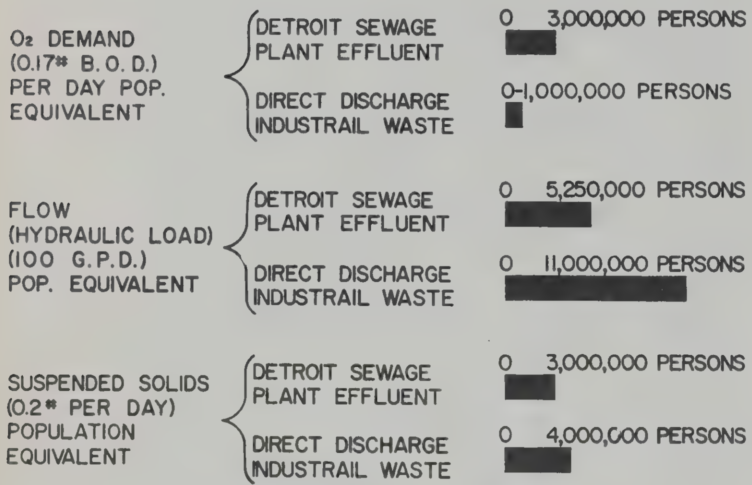

Figure 1. Daily pollutant loading on the Detroit River.

It must be presumed that the difference between the three-million-person BOD population equivalent load on the river, as measured by the Department of HEW, and the apparent remaining 63% of the 47,000,000 person population equivalent BOD discharged by the sewage treatment plant, was met in part by the heavy chlorination practiced at the sewage treatment plant.

The same 1964 City of Detroit Sewage Treatment Plant Operating Report indicates an average of 91 per cent of the effluent chlorine demand was satisfied, so that roughly 10 per cent of the BOD of the 30,000,000 person population equivalent remaining was discharged. This bears close resemblance to the 3,000,000 persons noted in the HEW report.

With respect to solids in the waste water going into the sewage treatment plant, the 1964 operating report notes a daily removal of 93% of the settleable solids and 59% of the suspended solids. Using these figures with those of the Department of HEW report, we can estimate that over 4.3 million pounds of settleable solids and over 1.4 million pounds of suspended solids were applied daily to the Detroit sewage treatment facility.

Utilizing a generally accepted figure of 0.2 pounds of suspended solids per capita per day as a criteria, it can be easily seen that the population equivalent of the influent into the Detroit Sewage Treatment Plans is about 7,000,000 persons, based on the suspended solids loading.

Figure 2 indicates the relationship between the industrially originated portion and the so-called domestically originated portion of the total waste water load with respect to flow, BOD, and suspended solids content of the waste, from an area with a population of only 2.8 million persons. It can be seen that 94% of the BOD of the polluting waters, 83% of the flow of the polluting waters and 72% of the suspended solids in the polluting waters are really originated by industry. In other words, 70% to 90% of the total water pollution originates with industry.

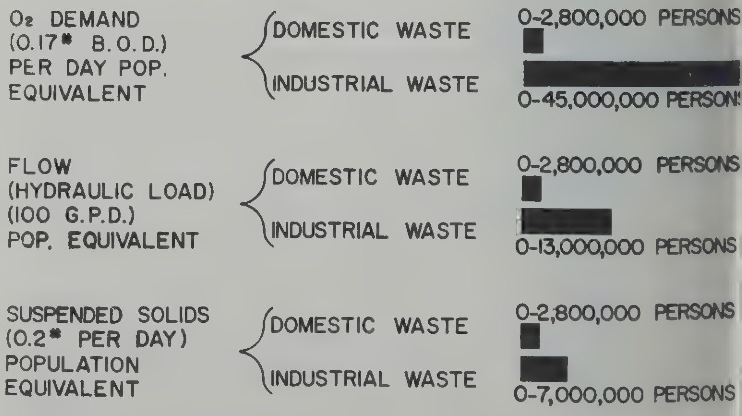

Figure 2. Daily pollutant loading on the Detroit River without waste treatment.

This seems to be conclusive evidence to me that those of us engaged in industrial building and systems design are really in the forefront with respect to the water pollution war now being waged.

Professional Practices

Now that we have determined how important we are, how are we doing? Not so well. Unfortunately, we are consistently failing to include anti-water pollution thinking in our everyday building and system design efforts. Many considerations are often completely overlooked. For instance, it is sometimes much more practical to select waste treatment processes to serve an industrial building which are low in first cost and relatively high in operating costs. This practice, while contrary to the usual municipal waste treatment practices, often permits capitalization with 100 cent dollars to be minimized and operation with 50 cent dollars to be made much more attractive.

In addition to the preceding difficulties, we often select building sites too small to accommodate the settling basins, lagoons, or other devices needed to treat the industrial wastes emanating from our buildings. We often fail to separate our wastes into separate plumbing systems within our buildings and end up with a combined industrial waste conglomerate that defies treatment and makes selection of proper piping materials a near impossibility. Often cities will accept pretreated or diluted industrial wastes into their systems, but we fail to check local ordinances during preliminary building design and find ouselves required to provide a separate waste treatment system not anticipated in the original project budget. Process designers blithly go along with proven methods and fail to check for means of reducing industrial waste quantities or toxicities. Those of us engaged in industrial waste treatment system design as related to industrial building often overlook by-product reclaim potentials or water refuse possibilities.

We have often failed at convincing industrial clients of the desirability of a needed waste treatment facility because of our vagueness or inaccuracy in regards to first cost, operating expenses, power costs, and even financing costs. As a result the clients are trapped between the crossfire of competition and the armed charge of a fire-breathing regulatory agency. The previous data presented and other critics have pointed the finger of guilt at industry for some time, and now regulation enforcement may threaten the existence of some of those industries. We should not kill the goose that laid the golden egg, however, just because she dirtied up the barnyard. Later in the paper possible alternatives will be offered.

Waste Treatment Problems

There is no such thing as a standard industrial waste treatment system. The problems are so varied with respect to the nature and quantity of the wastes that the following flow diagrams must represent only a narrow look at problems arising in food processing, foundry, machining, glass, and plating industries. These systems should be considered only as possible solutions to problems faced by industrial builders.

Figure 3, on the following page, is the flow diagram for an industrial waste treatment facility operated by a large manufacturing company. The system basically consists of large tanks for the collection of soluble oil wastes and alkaline washing solutions. About once each day, the contents of a single tank are neutralized by the addition of acid and pumped to a pressurized retention tank where alum and soda ash are introduced to crack the emulsion and form a minute floc. Upon release thru a pressure regulator valve, the waste water enters an air flotation unit where once again at atmospheric pressure a reaction not unlike a suddenly-opened bottle of soda pop takes place. The rapidly rising bubbles of air combine with the alum floc and sweep thru the mass carrying the now free oil to the surface where the resulting sludge is collected by scrapers and sent to a holding tank. Oils and sludges collected are disposed of by off-site tank wagon disposal and/or incineration. The incineration of the waste must be watched to be sure the water pollution problem is not converted to an air pollution problem. After clarification, the waste water is passed thru a sand-gravel filter and detention pond in order to send a clear sparkling effluent to the receiving stream.

Figure 4 indicates a solution to a problem with a similar waste in which gravity skimming of the acidified, cracked emulsion is followed by an application of caustic soda to restore the PH to near neutral conditions. Since the salt (sodium sulfate) resulting from this neutralization is water soluble it is carried to the receiving stream. Some regulatory agencies place a limit on the amounts of such dissolved salts allowable in an industrial effluent. In such cases, lime would have to be used as the neutralizing medium and the resulting relatively insoluble precipitate, calcium sulfate, disposed of by dumping or burying. It should be noted this is not always easily done. Many times a solution to an industrial waste treatment problem seems only to create other problems. In the majority of cases where inorganic wastes are involved, the offending materials are only changed in state and reduced in quantity, thereby converting one problem to another.

A relatively new approach to the disposal of emulsified oil wastes, pesticide wastes and other wastes which have some BTU content, is by incineration at temperatures up to 2000°F. These systems, while low in first costs, generally require supplementary oil or gas fuel to maintain the incinerator temperature—the resulting disposal costs per gal-

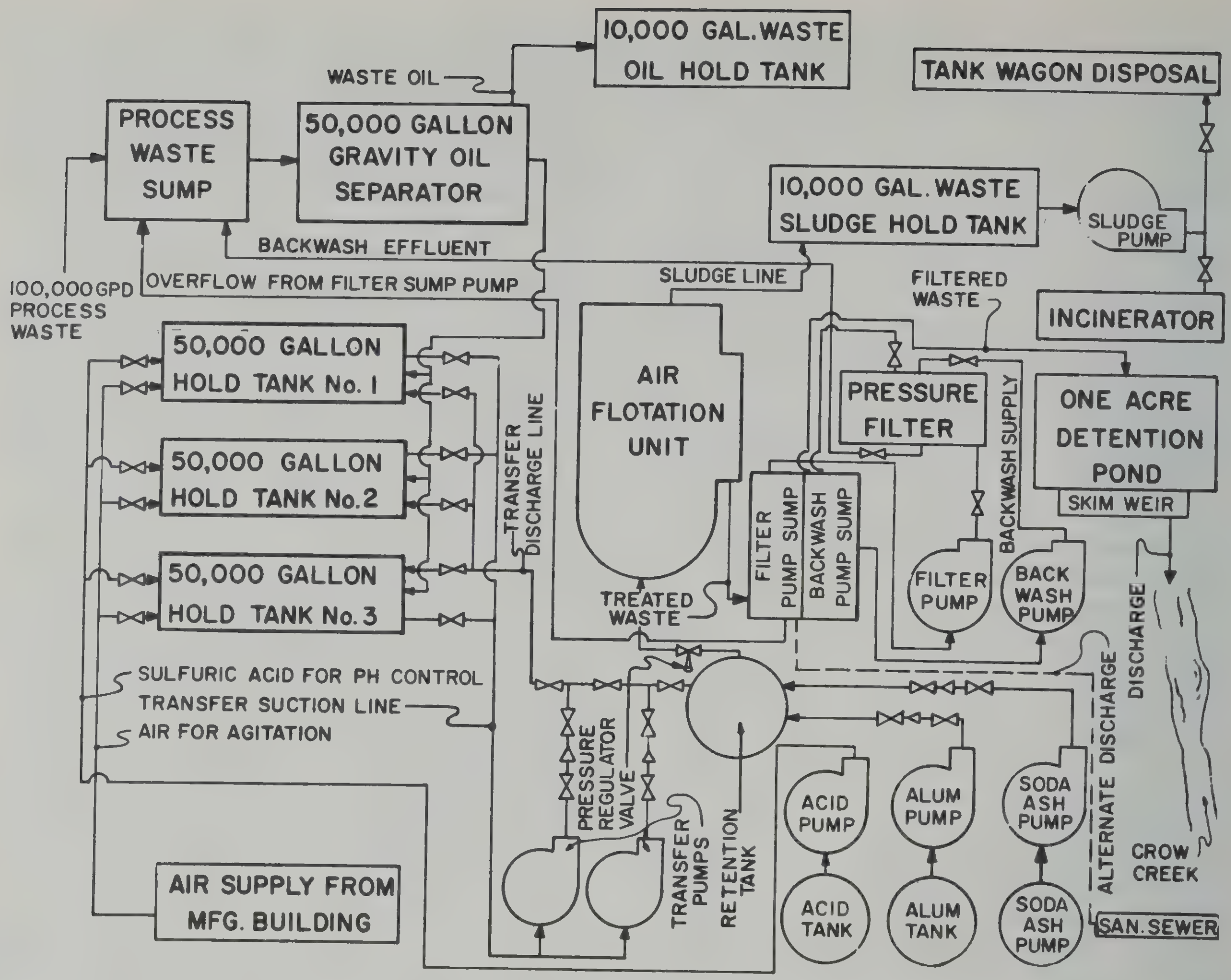

Figure 3. Flow diagram for a soluble oil and alkaline waste system.

lon of waste may be very high—in the neighborhood of 3¢ to 5¢ per gallon. In addition, air pollution restrictions can be a problem with respect to particulate emission, SO_2 content of the waste gas, and other factors.

Both of these systems (Illustrated by Figures 3 and 4) represent sizable installations. It must be remembered however that the new emphasis on water pollution means that building and system designers, and even owners, of small machine shops, tool and die shops should remember the pollution problem with respect to machine and building material selection and even employee instruction.

The waste waters from a somewhat complex system used in the treatment of wastes originating in a glass plant manufacturing TV picture tubes contain principally hydrofluoric acid, hexavalent chromic acid and grits from the glass polishing and grinding lines. The cost of a system to treat these wastes is about $300,000 exclusive of a building since the industrial waste treatment system will be housed in the basement of the processing plant.

Since the system was designed with a minimum first cost in mind several features were incorporated to permit continued production in the event a breakdown occured in the waste treatment process. Although a parallel standby facility could have been provided by duplicating system components it was decided to provide emergency acid holding tanks for acid wastes, an outdoor emergency holding pond as a lagoon for grit wastes and a chrome equalization tank by-pass to permit a limited extension of production in the event of a system breakdown. It is estimated that $200,000 to $250,000 was saved by this compromise.

The most noteworthy feature of the system is that under normal operation there should be no industrial wastes discharged. All waters are reclaimed for use in the plant process water system with the usual solids build-up controlled in part by the precoat filters. Chrome wastes are acidified, reduced to the non-toxic trivalent state using sodium metabisulfite, mixed with the hydrofluoric acid wastes, neutralized with lime and the resulting slurry added to the counterflow clarifier used for settling out grit wastes. This results in a sludge product containing grits and grinding wastes, calcium fluoride, calcium chromate and some calcium sulfate. The clarified sludge is dewatered and the sludge cake disposed of off-site. In this case, reuse of water has been used as a means of eliminating great quantities of

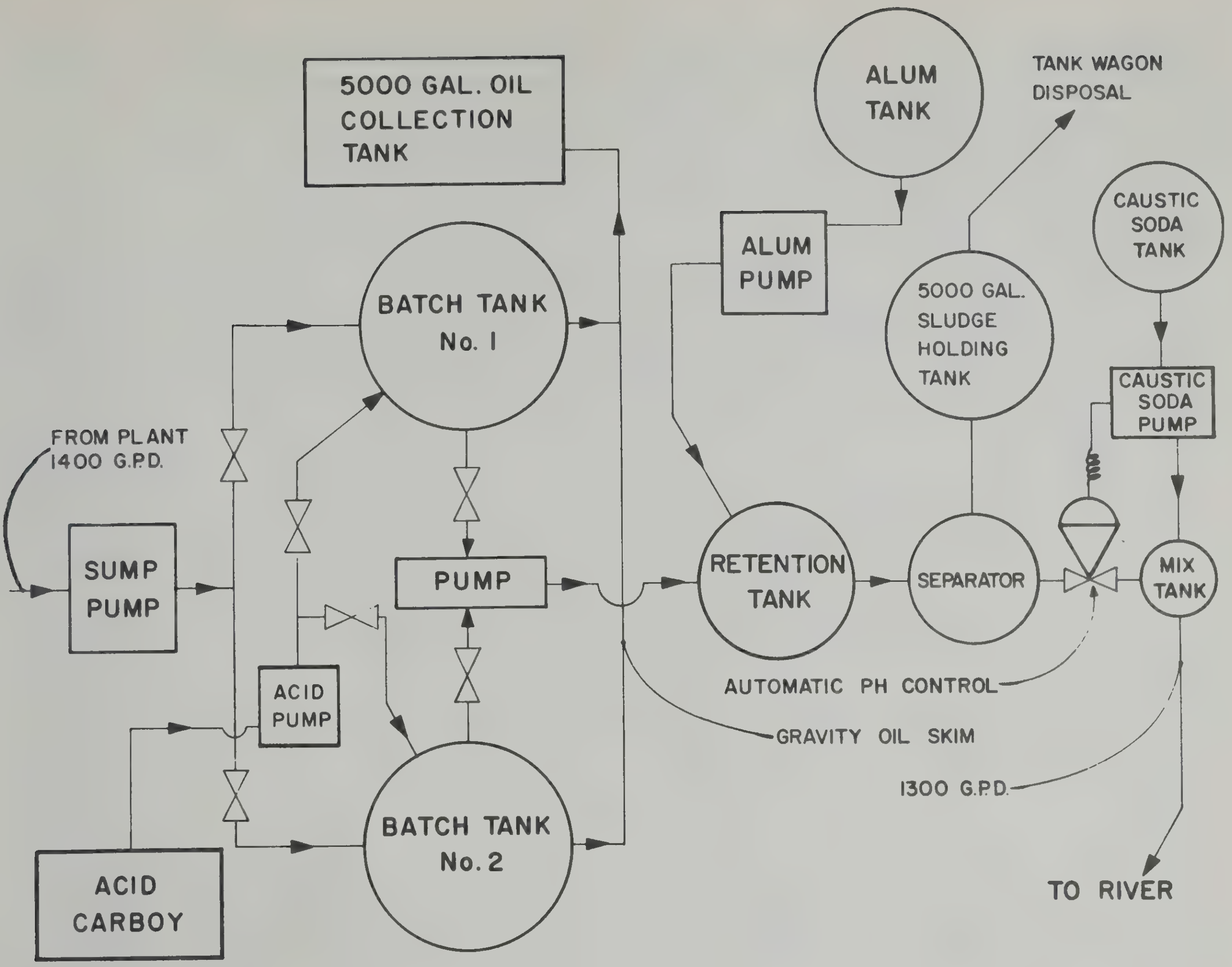

Figure 4. Schematic flow diagram for a soluble oil and alkaline waste system.

waste which would have had to be discharged to a nearly dry stream. If it were not for the fact that some system-blowdown to the stream might be required in the event an excessive dissolved solids build-up did occur, the entire system could have been worked out without involving the state water pollution regulatory agency. A special problem presented itself in connection with this project in the fact that all tanks, pumps and piping required careful consideration with respect to materials, coatings and linings. The combination of erosive grits and glass particles, coupled with varying concentrations of hydrofluoric and sulphuric acids, often forced compromise selections.

This system is typical of a situation in which building piping material selection, space requirements and tankage sizing is influenced greatly by the nature of the waste waters and the waste treatment process or processes selected. Space was saved by adding the chemical waste treatment precipitates to the system treating the inert grits and abrasives from the grinding and polishing processes.

Lastly, an example of the close tie between air and water pollution. In this foundry a cupola scrubbing system; collects all the gases and particulate matter normally discharged by a cupola stack (by means of a water deluge system), removes all the large particles, and returns the water to the dust collection system for reuse. A continuous addition of makeup water is required to correct evaporation losses, and the system suffers greatly from erosion caused by the particles in the rapidly moving water and air streams. In addition, high temperatures, combined with the acid nature of the collected particulate matter, accelerate corrosion rates.

It has been found that the life expectancy of water piping in foundry dust collection systems can be extended considerably by using a clamp-on type of pipe jointing that permits the piping to be quickly disassembled and reassembled, bottom side up. Most of the erosion-corrosion occurs on the pipe inverts, and such rotating of pipes can often double pipe life.

As can be imagined, the buildup of fine solid particles and colloidal matter finally does demand a blow-down from the recirculating system. Such wasted water must be coagulated, settled, and the sludge removed and dried before wasting to a stream. Often large cities whose total flow offers substantial dilution will permit a fixed number of pounds per day of suspended, dissolved, or very fine solids to be dumped into their sewer systems.

Such possibilities should be investigated during plant site selection or process design. If such is not possible, then the blow-down must be treated by means of sedimentation and/or coagulation, sludge thickening and collection, sludge drying, and finally sludge disposal. Investments will be substantial; financing must be completely analyzed.

These few examples indicate the complexity of industrial waste treatment. In addition to such wastes as mentioned previously, there are paint wastes, petroleum wastes, canning plant wastes, papermill wastes, pharmaceutical wastes, steel mill wastes, pesticide wastes, radioactive wastes, and so forth, ad infinitum.

As a result, there can be no such thing as a standardized industrial waste treatment system, due to the widely varying quantity and quality of waste waters from industry. Competition spurs our industry into constant process modifications, so that in any given plant the waste waters can vary from year to year or even from month to month. Architects and engineers are accustomed to correlating the variety of needs to be met by a specific system, building or facility. Waste water treatment considerations are another factor to be recognized.

Conclusion

The universities training young engineers for careers in water pollution control work offer few specific courses in industrial waste treatment and those which do limit such courses to vague generalizations.

The Federal government, however, seems to lack appreciation for these problems. In a recent article in *Water and Wastes Engineering,* Mr. Frank C. DiLuzio, Assistant Secretary of the Interior for Water Pollution Control stated, "If industry expects us to help them, they must also help us by providing information about the chemical composition of their waste discharges and about the nature of those processes that generate these effluents. In this way, we can possibly make available research results and technical data to assist them in solving their pollution problem." In the same article there was also some discussion of possible grants to industry to help solve their problems.

This does not seem to me to be the proper approach. As I mentioned earlier, Federal grants for the construction of water pollution control works seem to have already slowed the war against water pollution by fostering a dependent attitude on the part of the grant recipients. Also, funding authorizations have not been followed with adequate appropriations.

Industrial builders can neither wait for grants or research from the Federal bureaucracy nor can they furnish data, due to the constantly changing production processes, many of which are proprietary in nature. Industrial builders however, if unfettered by procedural paperwork, have the capacity to meet the new water criteria swiftly.

The previously mentioned constantly changing process waste water characteristics are the chief argument against the oft-cited proposition that it is better to build one large municipal waste water treatment system than many small individual waste treatment systems. Admittedly, the cost per gallon of treated waste water would be less, and it would be fine if the load on the large facility could be accurately predicted and would remain constant, but since it has been shown that roughly three quarters of the waste waters originate from the widely varying effluents of industry, this condition seems difficult to achieve. Hence the belief that individual waste treatment facilities for each industry are more desirable. In addition, such municipally built facilities would probably be delayed by Federal grant allocations and procedures, municipal bonding problems, and other difficulties.

Let us cure the disease at its source, not treat the symptoms after the sickness occurs. Let industrial builders and system designers who are the first to encounter water pollution correct this matter at its source. The establishment of water criteria standards among the states under the direction of the Federal government has been long overdue and is welcomed. Definite uniform criteria actually assist process planners, builders and waste treatment system designers by eliminating an area of uncertainty, but until new legislation is passed permitting industry a tax write-off of 100% of their waste treatment construction and operating costs, little progress will be made toward cleaning up our water resources. Industrial wastes generated by industrial buildings are the real problem. If tax relief is not forthcoming, an industry may be clubbed into submission by water quality regulatory agencies, or marginal profit companies may be forced out of business.

Can we afford such liberal tax concessions? I don't know. This is a problem for the Federal budget planners, but the problems arising from the program of Federal grants for municipal treatment works should serve as a warning that if such a solution is applied to the real water pollution program, e.g. industrial wastes, we may be faced with even further disappointments. Not only may we be disappointed, but we may find no industrial buildings to design and construct.

In the past we have all made a profit on water pollution; our automobiles, food, and everything we buy has been less expensive because we permitted pollution to occur. Now we must pay the bill, and it must show up in finished product costs, or increased taxes, or both. We are now reaping the harvest of our own greed. To prevent the harvest from becoming a disaster each person at this conference should actively support the case for substantial tax incentives which will encourage industrial builders to clean up their own waste waters. □

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building research
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New Towns: Frontiers or Failures?

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JOURNAL OF THE BRAB BUILDING RESEARCH INSTITUTE
building research

VOLUME 6, NUMBER 4
OCTOBER/DECEMBER 1969

EDITOR
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Building Research is published quarterly by the BRAB Building Research Institute, National Research Council, 2101 Constitution Ave., N.W., Washington, D. C. 20418. BRI members receive *Building Research* as a membership service. Subscription rates to non-members: $35 annually; $9.00, single copy. Special rate for college, university and public libraries; $20 annually. All subscriptions payable in advance in US funds. No discounts. Additional subscriptions or copies to BRI members or employees of member-organizations, $12 annually; $3.50 single copy.
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Building Research is intended as a means of disseminating information which has been, (1) presented at BRI conferences, workshops, and symposia, (2) developed by BRI Technical Committees, and (3) submitted by researchers involved in housing, building and/or environmental design. It is directed towards those who are involved in or interested in building science and technology and serves as a forum for presentation and discussion of pertinent topics.

BRI

The BRAB Building Research Institute is a national, interdisciplinary organization with an international membership dedicated to the science and technology of building.

The Institute encourages and stimulates needed research and development in the many diversified areas of the industry and its allied professions, and aids in the communication of ideas through the collection, correlation, documentation and dissemination of building science and technology information.

Membership is open to all individuals with an interest in the advancement of building science and technology.

Library of Congress
Catalogue Card Number 64-9377

New Towns: Frontiers or Failures?

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COMING—The next issue of *BUILDING RESEARCH* will carry the remainder of the papers presented at the 1969 Conference as follows:

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Glenn W. Saunders, Jr.
Edwin W. Baker
Emil Hanslin
Lee A. Syracuse

Session 4: Techniques of Construction and Design
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David Jay Flood
Edwin W. Baker
Warren Callister
Lee Ham

Session 5: Techniques of Construction Financing
Dr. Saul B. Klaman (Moderator)
William D. Ray
Robert M. Paul
F. G. Opelka

Session 6: Techniques of Selling, Leasing, Renting and Managing
Charles L. Strobeck (Moderator)
Philip Reilly
Peter W. Seibert
Emil Bouhaven
Donald V. McCallum

Special Guest
John Garvey, Jr.

building science news

Full-Scale Testing of New York World's Fair Structures

It is rare that the opportunity comes along to conduct full-scale controlled tests on completed modern buildings—up to and including the point of structural collapse. Yet, such tests can provide valuable data for engineers, architects, and others who wish to compare the actual strength and performance of structures with the theoretical predictions and findings derived from laboratory testing or examination of structural failures.

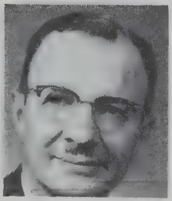
A new three-volume series, *Full-Scale Testing of New York World's Fair Structures,* presents the results of an effort almost without precedent in the field of building science—the controlled testing of full-scale modern building assemblies. Prepared by a Special Advisory Committee of the **Building Research Advisory Board,** the reports provide detailed descriptions of testing programs, results of tests, and comparative analyses for each of three buildings selected from the complex of structures built for the 1964-65 New York World's Fair.

Although the tests performed revealed unsuspected strengths and weaknesses, neither design practices nor building codes can reasonably be revised or modified solely on the basis of these few full-scale tests. The results do, however, highlight specific areas where further laboratory investigation, as well as additional full-scale testing programs, could lead to the development of improved design criteria and the establishment of more realistic performance requirements.

Volume I, Publication 1720; 1969, *The Bourbon Street Structure,* x + 128 pages, $4.25.
Volume II, Publication 1721; 1969, *The Rathskeller Structure,* x + 104 pages, $4.75.
Volume III, Publication 1722; 1969, *The Chimes Tower Structure,* x + 104 pages, $4.00.

These publications can be ordered from the National Academy of Sciences, Printing and Publishing Office, 2101 Constitution Avenue, N.W., Washington, D. C. 20418. For postage and handling, add 40¢ for the first copy ordered and 25¢ for each additional copy in the order. Payment must accompany an order for $5.00 or less.

Glenn H. Beyer, Former BRAB/BRI Member Dies



Glenn H. Beyer, one of the early leaders in housing and building research died November 4 in Ithaca, New York, at the age of 56. He was a member of the BRI Board of Governors from 1961 to 1964 and of the Building Research Advisory Board from 1959 to 1963.

A longtime enthusiast and one of the founders of the Building Research Institute, Beyer was a leading figure in the early development of the Institute. He served in many capacities including chairman of the BRI Research Committee and was instrumental in establishing many of the policies that have guided the Institute in its development.

Beyer was a graduate of Augustana College in Sioux Falls, South Dakota where he received his AB in 1935. He received his AM from George Washington University in 1939. He began his professional career as an economist with the Federal Housing Administration and during the war years of 1941-42 he served as director of defense housing coordination. From 1942 to 1946 he was deputy regional representative for the National Housing Agency.

In 1946 he became a lecturer at American University and in 1947 moved to Cornell University where he was professor of housing and design. In 1950 he was appointed as Director of The Center for Housing and Environmental Studies at Cornell, the position he held until his death.

Professor Beyer served his nation and the building industry in a variety of ways including, housing consultant for the Atomic Energy Commission and the Housing and Home Finance Agency. From 1957 until 1961 he directed a national study on housing needs for the aged. His writings were many, including, "Economic Aspects of Housing for the Aged," published in 1961. He was editor of the famous 1953 report, "The Cornell Kitchen-Product Design Through Research."

News of Members

Carl A. Giffels, member of the BRI Operating Committee, has been named president of the Consulting Engineers Council of Michigan.

Dr. Lev Zetlin, member of the BRI Operating Committee, and President of the New York consulting engineering firm of Lev Zetlin Associates, Inc., is currently working on Boston's $75 million Logan Air Terminal. Dr. Zetlin presented a preview of plans at the October meeting of the Prestressed Concrete Institute in Boston.

"With twice the passenger and cargo capacities of the coming super-jets, today's plane docking facilities, loading and unloading ramps and parking space would be overwhelmed," Zetlin said. "Solutions must be found and implemented immediately if we are to avoid complete air travel industry chaos."

BRI member **Donald E. Brotherson,** AIA, has just completed a study of "Insulation for Heating" (Technical Note #3) for the Small Homes Council—Building Research Council of the University of Illinois at Urbana-Champaign.

The 12-page publication describes the mechanics of heat loss and moisture movement, as well as providing thermal conductance and resistance values for eleven wall sections, eight roof-ceiling sections, and three floor sections, for varying amounts of insulation. Insulating materials included in the data are mineral wool batts, fiberglass or wood fiber batts, loose-fill of mineral wool, wood fiber, or vermiculite, and reflective aluminum foil. Conductance and resistance values are also provided for single, double, and triple glass, storm doors, and skylights.

The new publication includes a simplified method for finding the optimum amount of insulation, based on climate and fuel costs, as well as a means of determining the rate of return on additional construction costs expanded for insulation.

The use of vapor barriers for moisture control, and the determination of humidification requirements, both in relative humidity acceptable to the structure and its occupants and in amounts of additional moisture needed in gallons of water per hour, are discussed.

(continued)

Copies of Technical Note #3, "Insulation for Heating," are available for 25¢ each from the Small Homes Council-Building Research Council, University of Illinois at Urbana-Champaign, One East Saint Mary's Road, Champaign, Illinois 61820.

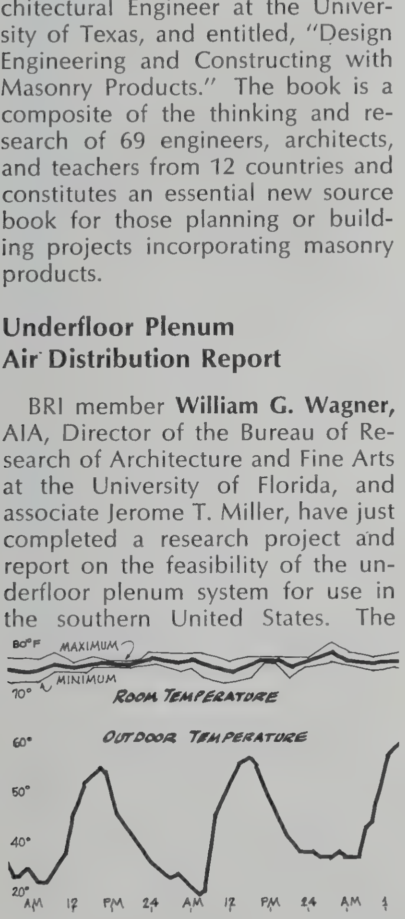
Masonry Conference Proceedings Available

The proceedings from the *International Conference on Masonry Structural Systems* held at the University of Texas in Austin last year are now available from the Gulf Publishing Company, Book Dept., P. O. Box 2608, Houston, Texas 77001. The cost is $35.00 per copy plus 4% tax for Texas residents.

The proceedings have been published in the form of a manual edited by Dr. Franklin B. Johnson, Chairman of the Department of Architectural Engineer at the University of Texas, and entitled, "Design Engineering and Constructing with Masonry Products." The book is a composite of the thinking and research of 69 engineers, architects, and teachers from 12 countries and constitutes an essential new source book for those planning or building projects incorporating masonry products.

Underfloor Plenum Air Distribution Report

BRI member **William G. Wagner,** AIA, Director of the Bureau of Research of Architecture and Fine Arts at the University of Florida, and associate Jerome T. Miller, have just completed a research project and report on the feasibility of the underfloor plenum system for use in the southern United States. The project was sponsored by the Forest Products Marketing Research Project, Southeastern Forest Experiment Station, Forest Service U.S.D.A., Athens, Georgia.



The report describes the underfloor plenum system—which is not new in concept—and explains the results of a series of physical tests on the prototype house while actually in use. The report concentrates on an evaluation of the mechanical performance of the system

BRI Organizational Members Awarded VA Systems Research Project

The Veterans Administration (VA) Research Staff has awarded a contract for development of a project on the "Application of the Principles of Systems Integration to the Design of the 'Nursing Tower' Portion of a VA Hospital Facility," to two San Francisco firms—Stone, Marroccini and Patterson; and Building Systems Development, Inc., both members of BRI.

Basic objectives of the project are to demonstrate the application of the "Systems Integration Design" approach to the bed portion (nursing tower) of a hospital, using the median size of 500 beds, and thereby provide a solution to these problems more effectively than conventional design and construction practices.

Industry will not be formally requested or solicited to develop new "products" nor to present bids for their incorporation in the ultimate "building systems prototype design."

It is planned, however, to utilize materials and systems now available on the market, or under industry development, but which will be available for open market procurement by the conclusion of the present project next summer.

This is the major difference in the method of approach from previous "systems integration" projects such as the School Construction Systems Development (SCSD) and the University Residential Building System (URSBS) projects.

However, the VA points out, this does not preclude consultant and industry representatives from jointly agreeing that some presently unavailable "product" should be developed. From this agreement may evolve a new "product" which could not only be included in the VA's research project, but be available and suitable for use throughout the building industry.

A report will be available for distribution upon completion of the present project in late summer 1970.

In the initial phase of the long range research project, completed last year, the VA determined that the "systems integration" approach is feasible for VA hospital design and construction.

Copies of the three-volume report on the initial project (Phase One), titled "Integration of Mechanical, Electrical, Structural and Architectural Systems in VA Hospital Facilities," are now available for $5.25, plus postage, from the Veterans Administration, Office of Construction (08C), 810 Vermont Ave., N.W., Washington, D. C. 20420.

New Research Center for American Plywood Association

The American Plywood Association formally dedicated its new million-dollar research center in Tacoma, Washington on October 20. The center is to be the nucleus of a technical development program devoted to "product quality, structural efficiency and imaginative design in plywood."

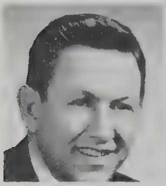
Following ceremonies in Tacoma attended by 200 plywood industry leaders, scientists and government officials, Karl R. Bendetsen, chairman and chief executive officer of U.S. Plywood-Champion Papers, Inc., delivered a keynote address on research. He said, "The bright, broad promise of research is a tomorrow free from mind-destroying drudgery, ample leisure, and abundant prosperity."

Harold Horowitz Appointed NSF Division Director

Harold Horowitz, AIA, former Technical Director of BRI, has been appointed Acting Division Director for the newly created Division of Institutional Resources for the National Science Foundation. This division is responsible for the Institutional Grants for Science Programs, the Graduate Science Facilities Section, and the Architectural Services Staff. Horowitz was previously head of the Architectural Services Staff.

Harold was with BRI during its most formative years and was responsible for putting together many of the Institute's technical activities including the Building Science Directory.

Robert McKinley to Receive ASTM Award of Merit



Robert W. McKinley, member of the BRI Operating Committee and Chairman of Financial Liaison, has been selected to receive the American Society of Testing Materials Award of Merit in recognition of his distinguished service to the Society.

The certificate of award will be presented at the ASTM Awards Luncheon on June 24 during the ASTM Annual Meeting in Toronto, Canada.

Computer-Generated Building Products Information System

A computer-generated information retrieval system that provides architects, engineers, designers, contractors and specification writers with current building products information was shown publicly for the first time by the Construction Specifications Institute (CSI) and Information Handling Services on April 14.

Called Spec-Data II, the system is believed to be the most complete information file of building products ever assembled for the architectural and construction industries. It is the result of nearly two years of joint research and development.

With Spec-Data II, product selection by product characteristic is made possible through unique computer programming, and data are displayed on a "side-by-side" basis, making comparison easy. The entire system is organized according to CSI 16-division format for construction specifications.

The user can find product data in the Spec-Data II Building Products File, even if he only has a fragment of information at the start, through use of these indexing methods.

The Spec-Data II Building Product File is available in two data configurations; one which allows the user to make a dry print, in six seconds, of any manufacturer's catalogue page, and a personal data station which displays all the same data in a compact desk-top unit.

Armstrong Cork Company Announces Promotions

Dwight Browning and David Zentmyer will assume broadened responsibilities in their positions as Assistant Directors of Research for Armstrong Cork Company upon the retirement of Vice President F. B. Menger. Armstrong Cork Company is an active Organizational Member of BRI.

Browning is a 1941 graduate of Mississippi College with an A.B. degree in chemistry. He also attended the University of Pittsburgh and became a Fellow at the Mellon Institute. He began his Armstrong career in 1950 and became a Research Section Head in 1956. In 1958 he was named Manager of Paint Research and in 1961 became Manager of Plastic Flooring Research. In 1962 he was promoted to General Manager of Building Products Research, a position he held until 1968, when he became Assistant Director.

Browning is a member of Building Research Institute, the American Chemical Society, Phi Lambda Upsilon chemistry honor society, Sigma Pi Sigma physics honor society, and the U.S. Naval Institute.

Zentmyer was graduated in chemistry from Juniata College in 1937. He earned a Ph.D. degree in organic chemistry from the University of Pennsylvania in 1948. He joined Armstrong's research and development organization in 1947. In 1959 he became Manager of Plastic Flooring Research. In 1961 he was named General Manager of Floor Products Research and in 1968 was appointed Assistant Director.

He is a member of the Building Research Institute, the American Chemical Society, the Society of Plastics Engineers, and the Society of Sigma Xi science honorary.

PSI Appoints James Gross Director of Research

James G. Gross, BRI member, has been appointed Director of Engineering and Research for Precast Systems, Inc.

Mr. Gross will direct all technical activities of PSI, which is the national marketing and development arm of forty major producers of prestressed and precast concrete products with 65 plants throughout the U.S.

Mr. Gross brings to PSI a distinguished record of accomplishment as Director of Engineering and Technology of the Structural Clay Products Institute, McLean, Va., a post he held for the past six years.

Mr. Gross has been active in many construction industry professional organizations and is author of numerous technical publications and articles. He is co-author of the recently-published book *Recommended Practices for Engineered Brick Masonry*.

Computer Simulation of Building Fires

A recent study at the NBS Institute for Applied Technology has explored the feasibility of simulating a building fire using a computer. This work, by J. A. Rockett, an NBS Research Associate sponsored by the Factory Mutual Engineering Corporation, has also indicated areas where further fire research is needed.

In the NBS simulation a building is divided into cubicles (a single-family house would consist of about 44 cubicles). Data on the amount and type of combustible material at a particular location and the effects of a fire at one location on all other locations accessible to it are included. Air movements are calculated and the geometric features affecting air movements are compiled. Sprinkler system details are included if appropriate to the particular building under study.

Editor's Comment

Special Guest Editor—The uniqueness of the BRI Spring Conferences last year dealing with the subject of new towns, and the particularly useful nature of the valuable data presented, enticed Jeanne M. Davis, AIP, to consent to be our special guest editor for this publication. Miss Davis is an urban planner of some considerable experience in studying and writing about new communities and volunteered to work with the BRI staff in collecting graphics, editing conference materials and planning this publication.

With all due respect to those who made presentations at the Spring Conferences, editing tape recordings, getting certain parts of the text materials approved, and collecting appropriate graphics has been a particularly difficult and sometimes frustrating task for Miss Davis. We are deeply indebted to her for her very valuable contribution.

Jeanne Davis graduated from George Washington University in Washington, D. C. with Bachelor and Master of Arts degrees in Geography, and later received her Master of City Planning degree from the University of Pennsylvania. She was a Fulbright Scholar at The Technical University in Delft, Netherlands, where she studied town and country planning.

She has traveled extensively in Northern Europe where she did research on new and expanded towns. She has also done considerable research on American new communities and has a first-name acquaintanceship with many of the foremost planners and developers in the U.S. She has worked for the Federal Government, and has been a planning consultant for the Baltimore Regional Planning Council, and for various counties and local groups throughout the country.

She is a member of the American Institute of Planners and served as a member of the Task Force on New Committees which prepared the AIP Background Paper No. 2, *New Communities: Challenge for Today*, published by the AIP in 1968.

In 1969 she was appointed chairman of BRI's committee on New Communities under Division I.

Author of numerous articles and reports on various aspects of urbanization and new communities, Miss Davis feels strongly that the country and, in fact, the whole world, is desperately in need of a coordinated information system for maintaining and developing knowledge derived from plans and experiences of new communities. She will continue to pursue this goal as she works with the Institute and in other ways as she feels appropriate.

We are also indebted to Robert M. Engelbrecht, AIA, for the masterful way in which he conceived and organized this conference for BRI. Bob put in many long hours and a great deal of expertise in developing the program format and in seeking out the most qualified people for involvement. At one point, BRI Administrative Assistant Mical Miller set up shop in Engelbrecht's Princeton, New Jersey, office with a special telephone to pursue Bob's numerous contacts and conversations with professionals throughout the country in preparation for the conference.

Finally, BRI is indebted to Carl Feiss, FAIA, AIP, for pinch-hitting for one of the session chairmen at the conference and for forthrightly preparing the Foreword for this issue.—BHE

Foreword

by

Carl Feiss, FAIA, AIP

The first Building Research Institute New Towns Conference, hopefully, will be the precursor for many to come. The title "New Towns: Frontiers or Failures" raised questions the meetings on April 28-May 1, 1969 in Chicago did not and could not answer.

In a lifetime of plugging for a viable new town program for the United States, this BRI meeting was, to my knowledge the first valid get together of building technicians on this subject. Considering the number of times the topic has come up at architects' and planners' meetings, it is very much to the credit of the BRI that it would experiment with a full scale effort to pull the planning, architecture, engineering, financing, and real estate issues together. For the purists in the concept team approach, this was a highly limited conference. From the standpoint of technological lags, it was very important.

When you get down to the concept team approach we must remember that each team member has to be proficient in his own specialty. Since there is a serious national lag in the whole new town concept, no essential specialist is yet really proficient in his own field. This means that lawyers, ecologists, public administrators, socio-psychologists, financiers, and all the rest, each must gear himself up in his own area before he is ready to sit around the long table for the first gab-fest with his peers in other professional, business, and development fields.

Maybe such an approach appears to be too single minded. Maybe the thing to do is to get everybody from all essential fields together at the outset and by self-help in a team approach, build up the comprehensive knowledge for the positive new town programs we need. I am inclined to think that at this juncture, numerous meetings of specialists communicating with each other can be most useful in focusing responsibilities in selected areas before entering into the generalist arena essential to comprehensive new community development. BRI and I could be wrong but I don't think so.

There are two serious problems posed by the BRI meetings. First, because of lack of definitions the subject matter ranged from luxury ski villages in the Rockies to Soul City, North Carolina. Next time around, undoubtedly there will be a zeroing in on the essential national issues and new towns by an accepted definition. What did show up was how highly developed and ingenious are some of our architects, site planners, and engineers in face of extraordinary climatic, topographic, and other matters. This was a positive and exciting part of the conference.

The other serious question to me was the lack of a sense of time imperative. The Congress is now studying new urban legislation based on the findings of several national study groups including the reports of The National Commission on Urban Problems (the Douglas Commission), *The Report of the President's Committee on Urban Housing* (the Kaiser Committee), and *The New City,* the report of the National Committee on Urban Growth Policy and associates. Unfortunately the design and building professions were all too inadequately represented on these important studies. On the other hand these professions have displayed a woeful lack of leadership in urban problems and at present could offer little in the way of positive contributions.

It is for this last reason that the BRI conference on new towns was particularly important. The attendance of prominent planners and architects, the president of the American Institute of Architects, the executive directors of other professional organizations, and the conference chairmanship of an architect, are hopeful signs that the design professions are now about to get into the act. We are 35 years behind the successful British program which has been led by the architectural profession. When the Congress passes new urban development legislation, presumably in the next 2 years, we, the design profession, will still not be ready and only partially trained if at all. An annual BRI type meeting is too long a gap timewise compared with the need to speed up our own in-house training.

This conference report of course cannot pass on either the spirit of the Chicago meeting or of the informal sessions on the side. It will show the wide range of matters discussed, a range that must and will change both in dimension and content as there is established a focus on the national issue, the building of the second United States and the rebuilding of much of the old to meet our doubling population by the year 2000. No greater or more exciting challenge faces us.

Where the technicians and professionals have failed in the national strategy for obviously essential city rebuilding and new city building is in the convincing of themselves, let alone the men who make and administer the laws and the rules, that the end result must be better physical layouts and better buildings of all types in better relationships and of better use to people than they ever have been. The end result is building the best America we can dream of. Let's get on with the job.

Techniques of Determining Location

MODERATOR:

Max Wehrli

There is a certain advantage in being a panel moderator of the first session of any conference. You are not inhibited by anything that has been said earlier. You don't have to worry about subsequent speakers. You can define the subject under discussion according to your own bias, and ask some questions you don't have to answer.

America has had new towns——planned towns —since the Pilgrims landed, since Penn laid out Philadelphia, and since the founding of Williamsburg. A study in the 1930's identified well over 100 developments, planned and started after the turn of this century, that might qualify for the title of new towns under various definitions. Such new towns would include Kingsport, Tennessee, and Longview, Washington, for instance.

This conference wisely has been directed to developments of the Fifties and the Sixties, the *new* new towns, if you will. The number and range of these is from 50 to 250, depending upon your definition.

Questions for the Panel

This panel has been asked to comment, among other things, on six specific aspects dealing with the techniques of locating new towns. What motivated the decision to develop a new town and what was the concept? What geographical factors influenced its location? What were the known limitations of the location? And finally, what unexpected factors have become assets or liabilities to the selected location?

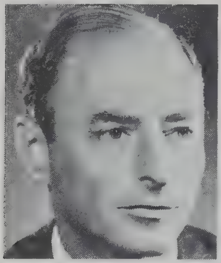
I would like to suggest several questions of my own. What qualifies any project for the title "New Town"? Is it the physical and geographic location with relation to other settlements? Is it the size of the tract acquired or the future population to be accommodated? Is it a legal or political entity such as the towns, surrounded or engulfed by metropolitan development, which have otherwise lost or soon will lose their identity? Is it the way they are physically organized for various purposes? Or, is it simply a good promotional gimmick to sell lots and houses in a large-scale subdivision.

All of these items have, I think, a relationship to the question of location and the techniques involved in determining location. I suggest that in the context of this conference it may help our thinking if we call most of the projects mentioned in the program "New Communities," and confine the term "New Town" to that particular breed of new community that is planned, organized, and built around a predetermined economic base—meaning an employment base, be it manufacturing, research and development, resort, retirement, or something else—which gives it an economic and self-sufficient reason for being. For example, Kingsport, Tennessee, conceived and built in 1915-1916, was planned around a number of diversified but interlocking industries. Longview, Washington, was built around the concept of the sustained yield of timber.

In this context, then, is my last query. Can the location of a Columbia or a Reston, both of which seem destined for engulfment by the rapid urban spread of two major metropolitan cities, maintain their identity and integrity over time as new towns, rather than as well-planned, attractive, and physically distinctive segments of a two-city metropolitan complex?

This question may or may not be important in the deliberations of this conference, but I suspect it may occasion rebuttal from our first speaker. ☐

Max S. Wehrly is Consultant to the Urban Land Institute, Washington, D. C. A former Member and Chairman of the National Capital Regional Planning Council, Washington, D. C., he has also served as a Member and Chairman of the Northern Virginia Planning and Economic Development Commission and as Chairman of the Arlington County, Virginia, Planning Commission. In 1965, he was given the Distinguished Service Award of the American Institute of Planners for his work in improving the private development of land across the nation.



Site Selection for a Large Scale Community

by **Robert E. Simon, Jr.**

The term "New Town" as used by the program committee equals, as I understand it, large-scale development. "New Town" in certain planning circles has a more precise meaning, but I don't think that it is important to get involved in debate on semantics. So what I am going to talk about is determining the site for a large-scale development.

Building Will Occur

We know for sure that there is going to be building in the future. The building results from present need or future need—the need of an expanding population, of expanding purchasing power, as our standard of living goes up, and also the need of expanding industry. So we know there is going to be need for residential, commercial, and industrial development.

Now, this need for development comes not only from expansion, but also from relocation. We are all familiar with the relocation of rural people in urban centers over the past decade or so. This is a factor that will taper off, but is expected to continue to be substantial.

Also, there is the relocation of blacks—essential if our cities are to survive as viable and attractive places to live—from the central cities into the suburban and rural areas, and of whites from the suburban and rural areas into the central cities.

"The Players" Have Major Impact

Determining a location and evaluating a location depends to a major extent on who is doing it and from what point of view.

Let us look at the private sector first. The larger the entrepreneur, the more he can, perhaps, have an influence on the factors that determine location. A small entrepreneur who is dealing with a relatively small project can do nothing to affect his location except perhaps obtain rezoning. The state of facts as he sees them is the state of facts with which he will have to live.

At the other extreme is a substantial industrial corporation seeking a major installation. Where it goes it will create an employment base which, in

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Robert E. Simon, Jr., is President of Simon Enterprises, Inc., New York City. From 1961 until 1967, he served as President of Reston, Va., Inc. He has received the Urban Pioneer Award from the Department of Housing and Urban Development and the Andrew J. Thomas Award for Pioneer in Architecture from the American Institute of Architects.

turn, creates demand for housing and services. This makes for greater flexibility and a greater choice among possible locations. Selection of the site may shape existing conditions—the character of the location is changed.

In addition to large and small users and developers there are in the private sector civic groups, regional planning associations, and others involved in site selection. They do not have the responsibility of implementing their decision-making with investment in design and construction. Accordingly they have the most flexibility of all in the private sector.

In the public sector—and we are seeing greater and greater involvement of the public sector in site determination—we have the whole range of Federal, State, city and county agencies that have the capacity to look out into their environs and select a site for a particular purpose. The selection decision can be of greater influence on location value than any inherent attributes of the site.

As I said, the more powerful the "who" is, the more control he has over the controllable factors which go into site value.

Transportation Very Important

Let's take a look at transportation networks for a moment. Where transportation goes—roads, railroads, airports—is of enormous importance to the future development of any area. The small developers in the private sector can have no influence on this at all. A major developer might have. Government certainly can and does have an influence.

An example of this is the great debate that took place in Washington in the early 1960's between the President's Advisor on Scientific Affairs, Jerome Weisner, and the National Capital Transit Authority on the location of the subway for Washington. Weisner took the position that it was logical to put the rapid transit lines out where there are no people so as to shape the future of the metropolitan area. The National Capital Transit Authority preferred putting the rapid transit line where the people already were so that the line could be financially viable from the first day on. The Authority prevailed and thus the opportunity for a major impact on shaping the future of the Washington metropolitan area was lost.

Of course, we know that there are no absolutes in terms of the time and distance it takes for people to get to work, which is what the transportation network is all about. It varies from community to community. In the New York City area, an hour-and-a-half commute each way is not considered extraordinary. Yet in many communities 15 or 20 minutes' distance is considered the outer limit that a commuter can be expected to travel. So one cannot be dogmatic about time-distance except to say that it must relate to existing conditions within each area.

In former times, sites were determined largely by the location of transportation networks which were then harbors, rivers, and railroads. Transportation is still the most important single factor in the decision-making process. But, today we look principally at rapid transit, freeways, and airports.

Utilities Important

Within a frame of reference of reasonably good transportation, utilities are the second most important matter for the average private developer—sewage disposal and water supply. We usually assume that electricity and gas can be provided by private utilities.

Factors Beyond the Developer's Control

There are a few elements over which we have no control: climate; the presence of water as an amenity as well as a utility; trees; the vegetation on a site and in an area; and hills and valleys. These elements: climate, topography and soil condition affect site selection.

Other factors over which we have no control are existing improvements: the existence of a university; the existence of an industrial base; the existence of a major metropolitan area with sophisticated and specialized professional people.

Factors The Developer Can Influence

There are two other factors affecting site selection that can to an extent be influenced by the developer, be he private or public.

The first of these I call the climate of opinion: What do the town fathers, the city fathers, the county fathers, feel about large-scale development, about zoning, about industry? The climate can be affected by skillful public relations.

The second is the problem of land cost. You will hear later from other speakers about the techniques of acquisition which follow site identification. A very skillful land assembler can buy large acreages at a price that a less skillful buyer could not possibly match.

The Appropriate Role for Government

Government participation in large scale development is essential. However, at present Government is only fulfilling its appropriate role in exceptional instances. It is wasteful of public funds and costly to the consumer for Government to continue to limit itself to its present degree of participation.

Title X and Title IV programs of HUD designed to encourage large scale development by private builders do not constitute adequate or equitable means of making a significant dent in the nation's urban problems. This is exaggerated even further by the by-product of the construction of transportation systems.

Government is largely responsible for the major transportation networks. As we have seen, ready development sites are generated as a result of

Government investment in transportation facilities. These sites should be in government hands at the same time as the planning is done and the acquisition of the transportation network is made. In this way, neither the farmer with his potato patch nor the land speculator will get the windfall of land increment resulting from Government investment; instead, the community at large reaps what it is entitled to reap from its investment.

As in many countries of the world, our Government should become involved in land banking. The outstanding example in this country of such involvement is the Urban Development Corporation in New York State. Set up by Governor Rockefeller with initial potential of one billion dollars, UDC may use its power of eminent domain to acquire significant land masses, its authority to disregard limiting provisions of local zoning and building codes, and its statewide conscience to insure provision for all kinds of citizens to be housed in its new communities.

All 50 states should have UDC's and the Federal resources should be available to supplement their efforts. UDC's are needed at municipal and county levels as well.

I don't suggest that Government go much further than acquiring large tracts of land and planning for their future development. I don't suggest that building shouldn't be in the private domain to a large extent, except where the private builders are unable to operate—which today is the case with low-income housing, and here private contractors could still be used.

I believe development authorities, development districts, and similar institutions should be encouraged. The builders benefit because they don't have to face the hazards of land assembly, the hazards of long-range carrying costs, or the hazards of politics and zoning.

We need new communities. We need new towns. We need new cities. And we need to renew existing cities.

Reston

To relate this briefly to Reston, Virginia, the New Town with which I am associated, Reston in 1961 was located 18 miles from Washington and 5 miles from a new facility, which was under construction, the Dulles International Airport. Washington was one of the fastest-growing metropolitan areas in the country. Fairfax County was either the first or second-fastest growing county in the country. It was projected to grow to 420,000 people by 1980, with employment projected at 160,000. Washington had its massive social problems and Reston was looking toward sharing in the out-migration of blacks to the suburban areas.

The transportation network is a long story. Briefly, the Dulles access highway was under construction. Reston never got access to it. But Route 7 more or less paralleled the Dulles access highway from Tysons Corner out to Reston, so it was a psychological matter that made us want to get access to the highway. In terms of time-distance, Route 7 was almost identical.

There were employment opportunities; in 1961 the area was growing industrially. Dulles Airport was expected to be a massive employer. It hasn't turned out that way as yet, but international airports, just by their very nature generate employment in their environs. People in some nearby sections of Maryland had quicker access to Reston than to downtown Washington.

As far as the utilities were concerned, the nearest trunk sewer was quite distant from Reston at the time of initial acquisition. With Federal funds it was extended to within less than a mile of Reston's boundaries.

I won't spend any time extolling the natural amenities, which are great. The topography is pleasantly rolling, the soil dry and well drained.

The climate of public opinion in 1961 was something else again, but we decided to brave it. It got very exciting.

We had incredible cooperation from the press. During the 10 days before the seven men and women comprising the Fairfax County Board of Supervisors had their opportunity to vote, the Washington Post had seven articles on Reston, one an editorial; the Star had six articles on Reston, one an editorial; the Virginia press had banner headlines. And I think that press cooperation is one of the reasons why, when these seven people cast their vote, they voted unanimously for the new zoning ordinance and proposed change in the County Master Plan.

You will hear later from Glenn Saunders, who is Reston's Executive Vice President, on the planning of Reston. I am no longer connected with it, but I am happy to say that the word I get from my friends down there is that Reston is a success. I will tell you that the reason I am not there was that at a crucial time following the money shortage of 1966, I was very short of funds, and Gulf Oil Corporation decided to reserve its capital until it could be in the driver's seat. Since Gulf has been in the driver's seat it has provided capital, and Reston is doing just fine. ☐

Land Acquisition for Lake Havasu City

by **Robert G. Krechter**

I will begin by relating the story of how our manufacturing corporation became involved in the land development business, and will close with our philosophy of determining land suitable for development into a new town.

The original concept of the development of Lake Havasu City is the product of Robert P. McCulloch, Sr., founder and now Chairman of the Board of McCulloch Corporation (a major manufacturer of chain saws and outboard motors), McCulloch Oil Corporation, and McCulloch Properties, Inc. Mr. C. V. Wood, the President of McCulloch Oil and McCulloch Properties, as well as the Executive Vice-President of McCulloch Corporation, is the master planner of Lake Havasu City. Mr. Wood is perhaps best known as the individual who conceived, planned, financed, and implemented the construction of Disneyland and operated that recreation center during its formative stages. Other national recreational facilities master planned by Mr. Wood include "Six Flags Over Texas" and the Lake Meade resort known as "Lake Meade Marina."

Lake Havasu

Lake Havasu itself is the result of the damming of the Colorado River by Parker Dam, which was constructed in 1939. The Colorado River and Lake Havasu are the water playgrounds for the 10 million population center in Southern California, because they are closer to this greater metropolitan area than any other large freshwater lake and river.

Lake Havasu is 40 miles long and at places 2½ miles wide. The lake is extremely stable, never varying in elevation more than plus or minus 2½ feet the year around. This lake supplies, through the aqueducts of the metropolitan water district of southern California, all of the Colorado River water delivered to the Los Angeles metropolitan area. These aqueducts have a capacity of one billion gallons per day. The intakes of the district are located a short distance north of Parker Dam, and Lake Havasu City is approximately 25 miles north of the Dam. Therefore, in addition to being a stable lake, there is a constant gentle current, assuring a continually fresh supply of water to the Lake Havasu reservoir.

McCulloch's Interest in Lake Havasu

In connection with the Corporation's production of outboard motors, Mr. McCulloch in 1959 acquired 3,500 acres of land on the Arizona side of the Colorado River, as well as the assignment of a concession contract of 17 years duration over a 1,100 acre peninsula of Federal land jutting into Lake Havasu. The contract authorized the operation of a general recreation resort on this land, then known as Site 6.

Because Lake Havasu was an ideal fresh-water location for an outboard test center, the McCulloch Corporation established in 1959 an outboard test center at the tip of the peninsula. Later, in connection with its testing facilities and in conjunction with the concession contract held from the Fish and Wildlife Bureau of the Federal Government, additional docking facilities were constructed. A trailer court facility, including a swimming pool and recreational buildings were added during the period from 1959 to 1963.

The Need to Relocate Industrial Facilities

In 1961, as a result of the installation of new radar towers for runway control of the Los Angeles International Airport, a dramatic change took place in the status of McCulloch Corporation's manufacturing property in Los Angeles. Land originally purchased for $15,000 per acre suddenly was rezoned allowing 160-foot heights; it therefore became extremely valuable for hotels and for office building complexes. Organizations such as the Kratter Corporation, Holiday Inn, Tishman, and Del Webb produced offers ranging from $250,000 to $300,000 per acre for the 63 acres of land held by the corporation.

Equally dramatic was the rise in property taxes on this land. The corporation suddenly found that

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Robert G. Krechter is Vice President-Administration, McCulloch Properties, Inc., Los Angeles, California, having previously served McCulloch Properties as General Counsel and Secretary. He is a Member of the California Bar, the Federal Bar and is Chairman of the Committee of the Real Property, Probate, and Trust Section of the American Bar Association, covering the Federal Full Disclosure Land Sales Act.

it was paying in excess of $200,000 per year for property taxes alone. It became obvious that the industrial facilities had to be moved.

Advantages of the Lake Havasu Site

The perennial favorites such as Wichita and Kansas City; Denver, Colorado; Orange County, California; and Phoenix were suggested. However, Mr. McCulloch determined almost intuitively that Lake Havasu would be an even better place to relocate.

Here was an ideal desert climate and land bordering on a beautiful fresh-water lake. The location was equally good from a growth standpoint, because it was almost in the center of a triangle created by the burgeoning cities of Los Angeles, Las Vegas, and Phoenix. It has the advantage of being almost in the center of two major east-west highways, Interstate 40 (formerly Route 66) and Interstate 10 (the major east-west highway connecting Los Angeles to the southwest).

On the other hand, it should be pointed out that Lake Havasu City was truly a community proposed for development in the middle of nowhere. The closest town was Needles, California, with an estimated population of 5,000 people. The area's only source of employment was a fishing resort, general store and cafe, and small airport facility. In fact, there were at the time no centers of population or development oriented to the Colorado River or any of its lakes from the State of Colorado to the Mexican border. With the exception of Lake Havasu City, the same is true today.

The Land Use Plan for the Lower Colorado, covering the 250 miles from Davis Dam to the Mexican Border, was approved by then Secretary of Interior Stewart Udall in June 1963. The plan provided that only one lakeside parcel of land would be allocated for urban development on this portion of the Colorado River—that at Lake Havasu City.

In summary, the area presented the natural assets of an ideal desert climate for work and leisure activities; a large, usable, and stable fresh-water lake; natural beauty in the form of rugged desert mountains rimming the lake. It presented the liabilities of isolation—with the accompanying problems of no supporting cities from which to draw labor, industry, supplies, or population; difficulty in attracting financing; and lack of any transportation and communication facilities.

In spite of the preceding liabilities, the overall attractiveness of the area, including the opportunity for recreation and sport activities, leisure living, and excellent climate convinced Mr. McCulloch that he would relocate his facilities at Lake Havasu if enough additional land to build a city could be acquired.

Priorities

The priorities established were as follows: **1.** Acquire additional land. A total of 16,500 acres was accumulated; 3,500 acres were purchased originally in a checkerboard pattern, and the remaining 13,000 acres were acquired through complicated negotiations between the Federal Government and the State of Arizona, then by public sale of the land by the State on August 2, 1963. **2.** Devise master land utilization plan. It is important to point out that we determined an ultimate population of slightly in excess of 100,000 people as being the ideal size for the community and limited the size of the minimum lot to 12,000 square feet (an aggregate of 2.5 lots to the acre or 40,000 lots on 16,000 acres of land.) **3.** Create a small, complete city with a solid base of industry. It will include hotels, motels, and restaurants; shopping facilities; schools and churches; single-family houses; apartments; a civic center with professional buildings; a public library; a public utility building; and the first circular post office building in the United States. **4.** Develop the recreational industry of the area. **5.** Maintain a high standard of development and constant growth for the community to insure the creation and maintenance of high property values and a continuing increase in value of the property.

In support of this latter point, the most significant contribution to insure the continued growth of the recreational aspects of Lake Havasu City was the acquisition of the London Bridge by our corporation in April 1968. The then Lord Mayor of London, Sir Gilbert Inglefield, dedicated and laid the cornerstone of the bridge at Lake Havasu City. The bridge is scheduled for completion in early 1971.

Summary

As can be seen from the foregoing, our policy is to find land that is highly desirable from a living standpoint and then attract the population and create the city. Factors that we consider include:

1. Good year around climate.
2. Outdoor recreational opportunities.
3. Reasonable proximity to growth centers.
4. The potential of producing a good and adequate water supply; transportation potential; proper terrain.
5. Utilities, such as electricity and natural gas, are usually available or arrangements can be made to bring them into the community.

To repeat, the overall concept is to find and develop land that people would like to live on in a place where they can work and enjoy outdoor recreation in close proximity to the area in which they live. Contrary to other major land developers, we do not seek land close to where the jobs are located. Rather, we seek land desirable from a living standpoint and then move the industry and the jobs to the land. ☐

New Town Planning for Rural America

by **Donald L. Henderson, P.E.**

Today I would like to address my comments to you primarily on the rationale supporting the concept of the new town as it begins to appear in sharper focus within the general fabric of our American culture.

A brief review of the history of cities offers some insight into the shadows which shroud some of our cities today, and I believe outlines some indicators of future trends.

In the beginning, the city was a place of refuge and security from the marauders, bandits, and slavers. Then the city became a marketplace and a trading center. In the beginning of this century, a new change took place; the city became a producer of economic wealth. Today I believe we are in the midst of an interregnum heralding another change for cities, and most importantly the large-scale introduction of the new town to the ever-changing and dynamic American scene.

Industry's Needs—Yesterday

To understand the change occurring today, we should first examine the last major change, which took place at the beginning of this century. That is when the city became the center of economic production. In this picture we find that as industry was becoming large and highly complex in its operations, demands for services required for efficient and profitable manufacturing functions could be found most conveniently in the cities. Here rail networks and marshalling yards were already established. Electric power and steam generating plants were already in existence, with attractive site and rate structures for the industrial customer. Here also were existing financial institutions and a great many other professional services, all within convenient reach of the plant when needed.

Municipal services of special importance included fire and police protection, sewage disposal, and copious supplies of high-quality but cheap water. Labor, with its limited mobility, could be concentrated in high density in these urban centers.

All of these services so necessary for a manufacturing operation were administered by a fairly simple political structure that left the manufacturer free to cut and bend his metal and then assemble his finished product for the consumer.

It should be noted that, although the industry had become relatively large, its end-product was

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Donald L. Henderson is supervisor of the Construction Engineering Department for the Chrysler Corporation, Detroit, Michigan. He is a registered professional engineer.

primitive by today's standards. Today, under the varied and intense pressure of the explosion of technology, the attractive conditions which greeted industry in our cities in the beginning of the century have now become restrictive and, in many cases, prohibitive for expansion and growth.

Industry's Needs—Today

As the product of industry has become more sophisticated, so, too, has the facility which produces it. The single-story concept for manufacturing operations has almost completely supplanted the multi-story plant. In addition, extensive parking lot requirements are now needed. Functional requirements such as these make it exceedingly difficult for manufacturers to locate new plants in today's cities, where large parcels of land are almost nonexistent.

Superimposed on this picture are the obsolete tax programs on land and tools of production which most cities have not changed significantly in the last 100 years.

So you see here a sharp contrast to the picture of 60 years ago. The very things which were optimum in 1910 now work against, and in some cases are even hostile to, the growth of industry in our existing cities.

Rural Areas are Attractive

In industry we must grow or we will perish, and today it is rural America that courts industry with open arms and an attractive dowry. Yes, it is back to the farm, but for new and different reasons.

First, as rural land is taken from food production, raw land becomes plentiful at attractive prices. The Rural Electrification Administration long ago brought electric power to practically every place in the country where it was needed. Gas fuel is now available in most locations. New freeways and better organized rail companies provide unobstructed transportation for labor and materials. Today's highly mobile labor force is within reasonable commuting distance of most rural locations. It is no small item, either, that construction is easier and cheaper in the country than it is in the city.

In addition to the clearly defined economic considerations for rural plant locations, cultural changes in America now support and encourage the move back to the farm. It was Thomas Jefferson, as you may recall, who admonished his listeners to stay away from the cities and to go back to the country, for the cities were the dens of iniquity. Today, we find many of the city's amenities in rural areas. These amenities are part of our modern technology; one example is the bus which makes possible the consolidation of rural educational facilities so their quality is comparable with that of city schools. In recreation, we notice certain trends occurring with regard to spectator sports. Television has brought many of these spectator sports to the living room. Movies and vaudeville, music and classical arts, to a considerable extent are relegated to the living room.

We also notice an enormous increase in participant sports, such as golf, boating, skiing, and so forth.

There is a sharp contrast between the conditions of living today with those that occurred 40 to 60 years ago. Then, all of these things, if we wanted them, had to be secured primarily in the cities.

Food distribution, storage, procurement, preparation and consumption have changed our way of living considerably from the way we used to live 40 to 50 years ago. Refrigeration and transportation, the supermarket and the automobile, the family freezer and the refrigerator, probably serve the same purpose as the pantry and the old smokehouse back on the farm. Packaged and prepared food today give us complete flexibility and a very broad menu the year round.

Also, if we take a look at our architecture and the economic framework in which it is set, the REA long ago made it possible for electricity, for illumination and for pumping water, to be brought to homes in rural areas.

The rural areas offer a sharp contrast to today's high-density living in urban centers, with the overhead powerlines, telephone poles, and so forth. Noise levels are considerably lower in rural areas than in urban areas. There is a very attractive and beckoning invitation to live in the country. Clean air, privacy—the things we are so much concerned about today in our urban centers—are all attractive features for people to live in a rural setting.

In addition, I think we find in high-density areas of urban America an administrative jungle. In sharp contrast, these problems are greatly simplified in the village or small town in the country.

In brief, as far as big industry is concerned, it is extremely difficult, if not impossible, to continue future growth and expansion within present urban centers. But because we must grow, most new sites selected are in the rural areas of the United States. There is a marketing benefit from this trend. In other words, if the end product needs better distribution in a particular area of the country, and you wish to establish a plant in that general area, you have much more flexibility when you look at the rural land settings than you would have if the search for a site were confined primarily to the large cities.

A New Rural Community

My company is constructing a new assembly plant in one of these rural settings. We are 35 miles southeast of Pittsburgh, Pennsylvania, and the setting is very rural. There are no communities. There are no facilities such as those normally found either in or contiguous to a large urban center; therefore, all of these things have to be constructed. I am talking about such things as waste disposal and water supply treatment centers. We are providing our own fire protection, our own police force—and the list goes on and on. In effect, we are creating within the framework of the plant itself what amounts to a new town with a highly specialized purpose, namely the assembly of automobiles.

In this area there will be developed a complete new town in the sense of a community for people to live, go to school, shop, play, and do all of the things that you do in a town. It will be a complete new town. The State of Pennsylvania has been working with the architect-engineers and with the Chrysler Corporation to establish frameworks and guidelines for all this work to continue in a healthy manner. Here I must emphasize that it is not the Chrysler Corporation that will build the new town, but the people of the State of Pennsylvania.

I might point out a problem I have observed. The State of Pennsylvania was, of course, most anxious to have us locate our new plant in their State. And it was done. However, they have found themselves completely unprepared, with respect to planning, as to how the new town is to be accommodated in this area. In other words, all reference is back to the traditional situation of building a new plant in an existing community. But we are going into an area which, as I just pointed out, is completely devoid of anything but cattle and corn.

What does one do? We anticipated a certain amount of difficulty, and took the precaution to secure a bountiful supply of land contiguous to the plant—several thousand acres, as a matter of fact. As plans are developed in cooperation with the State, the county, and the township, this land will be released for development. We will not have a haphazard growth situation, nor will we have a community that looks like an architectural garbage can.

This is the thinking and the work being done by the Chrysler Corporation. To the best of my knowledge, similar patterns are being followed by other major industries.

The Profit Motive

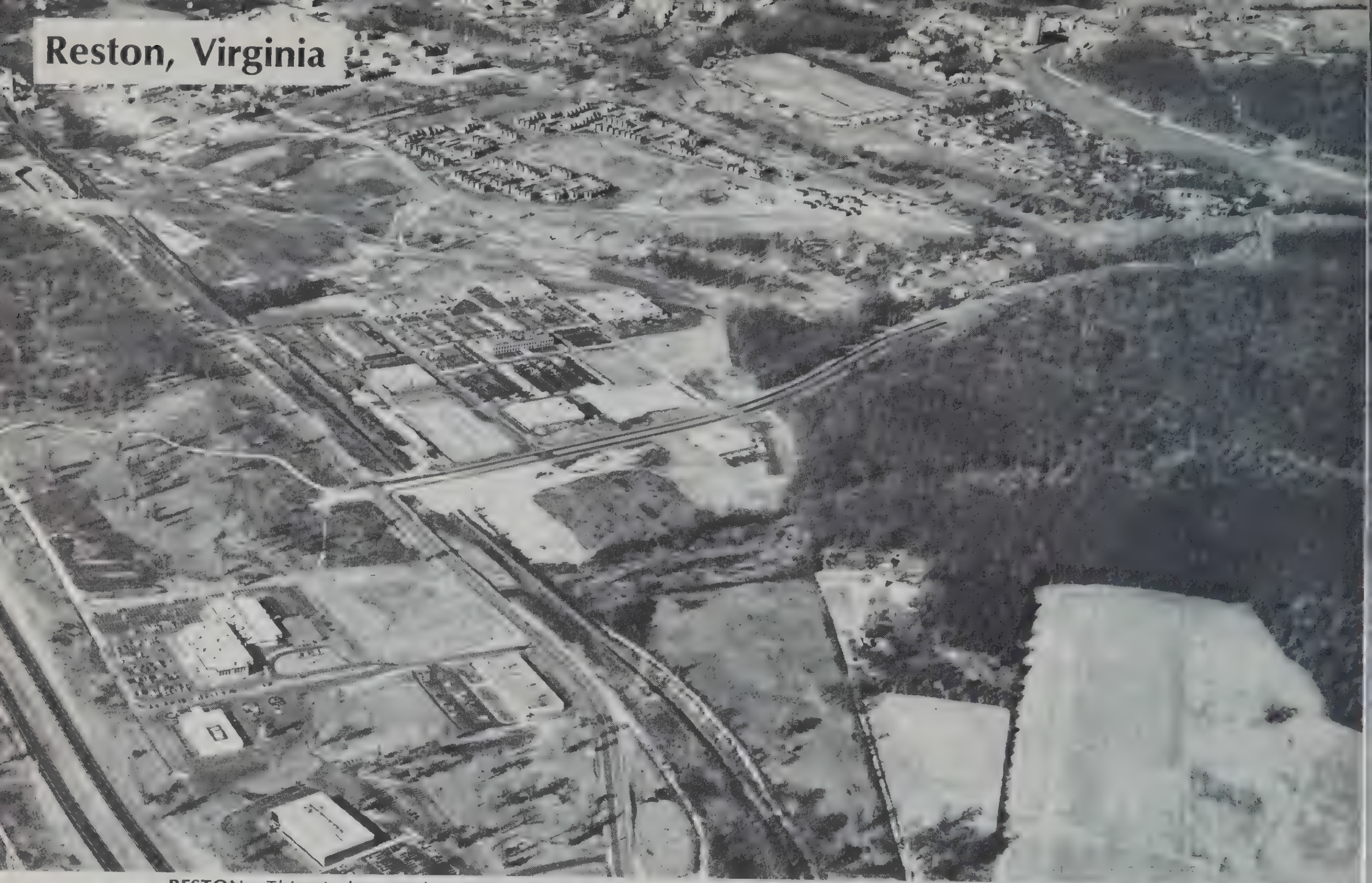
I would like to point out something else I think is significant. We are still a profit-oriented culture. The Chrysler Corporation is a private enterprise. We are in business to make money. Our investments must yield a profit. This is the reason we are building at New Stanton, Pennsylvania—to make a return on our investment and at the same time to serve America better with better products.

These are some of the principles which we work with in our new plant location, and I must say that we rather fortuitously found ourselves also becoming privy to establishing new town locations. We are hopeful that if a new town results from the location of this plant in New Stanton, it will be as great a tribute to the State of Pennsylvania as we anticipate our new manufacturing operations to be in the foreseeable future.

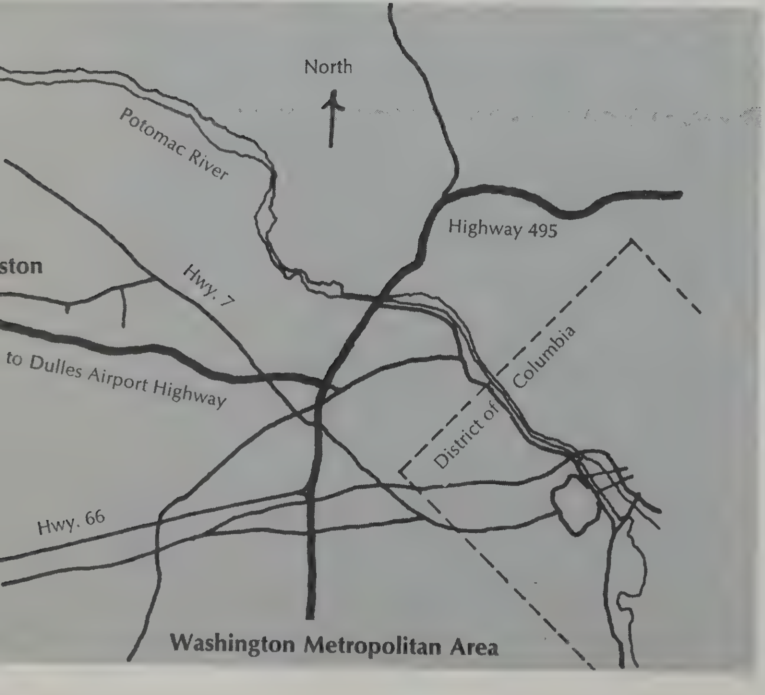
The general thrust of my talk might indicate that I believe that cities are no longer needed in our contemporary socio-economic matrix, and I do not want to leave that impression. Rather, I want to say that the principles I have touched upon here today portend two significant changes which we must plan for if we are to preempt the destructions of our cities. First, those cities with a heavy economic base in heavy industry must plan now to adjust to new economic supports, e.g. trading, education, regional medical centers, etc. Second, we need a new tool to help us create new towns to accommodate our needs and save our existing towns from strangulation.

We have copious supplies of planning capability and other necessary resources, but what is needed now is a catalytic agent to bring these essential ingredients together into a specific and meaningful course of action which will result in a new town. I believe such a catalytic agent would be the formation of a special Public Service Corporation organized for the purpose of building new towns. Such corporations properly endowed by the various state legislatures with powers of condemnation, bonding authority, etc., could logically approach the problem in its totality. Structured in a manner similar to our railroads and other public utilities, these Public Service Corporations could provide the same breakthrough for housing that their counterparts did for rail transportation and electric power. Incidentally, with all voting stock owned by the public the entire program would be an expression of our free-enterprise system. ☐

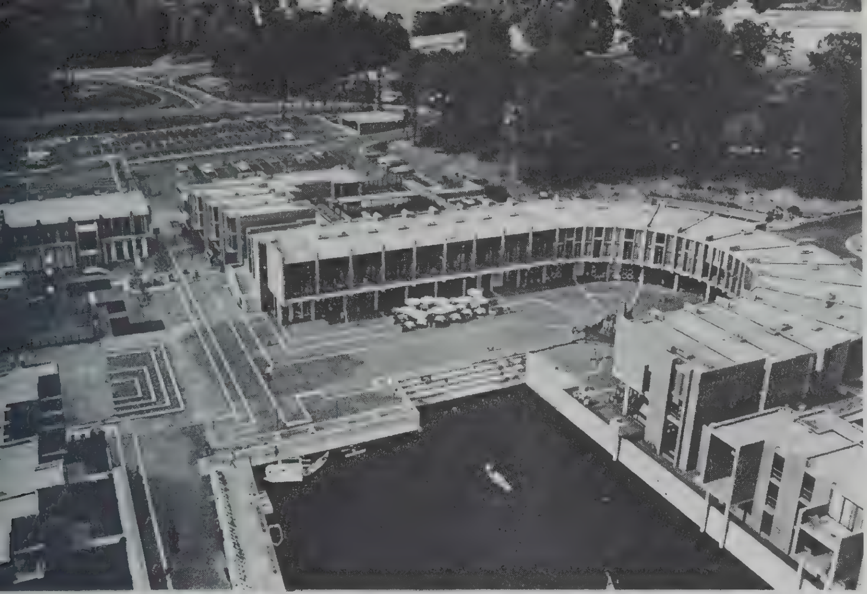
Reston, Virginia



RESTON *This airphoto (taken December 1969) shows part of Reston. The industrial area is in the left foreground and left center. On the far right is Lake Anne; Heron House, the high-rise apartment building, and Lake Anne Village Center are at the head of the lake. Single-family houses and clusters of townhouses adjoin the near side of Lake Anne. Newer construction—principally townhouses and apartments—upper left center.*



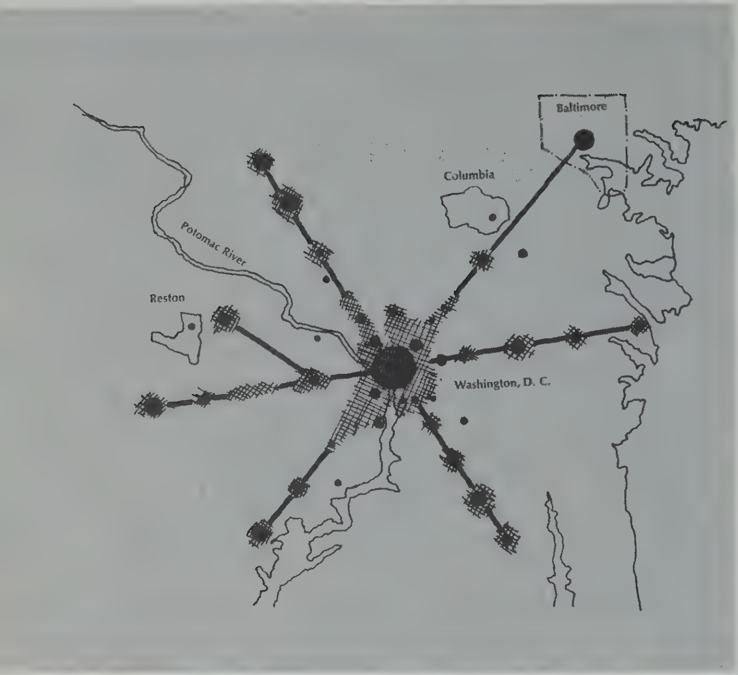
Below—View from Washington Plaza, Lake Anne Village Center, down Lake Anne. Exuberant children find many interesting structures to climb, crawl through, or jump over in Lake Anne Village. Notice the special lighting fixtures edging the lakeside walk (for pedestrians only). Townhouses and many of the apartments on the right have boutiques on the ground floor; backs of these buildings overlook the landscaped roof shown in another picture. Heron House's height provides a focal point for all Reston. Beyond Heron House, near the fountain, a cluster of Mediterranean-style townhouses overlooks the lake on one side and community-owned open space—a major feature of Reston—on the other side.

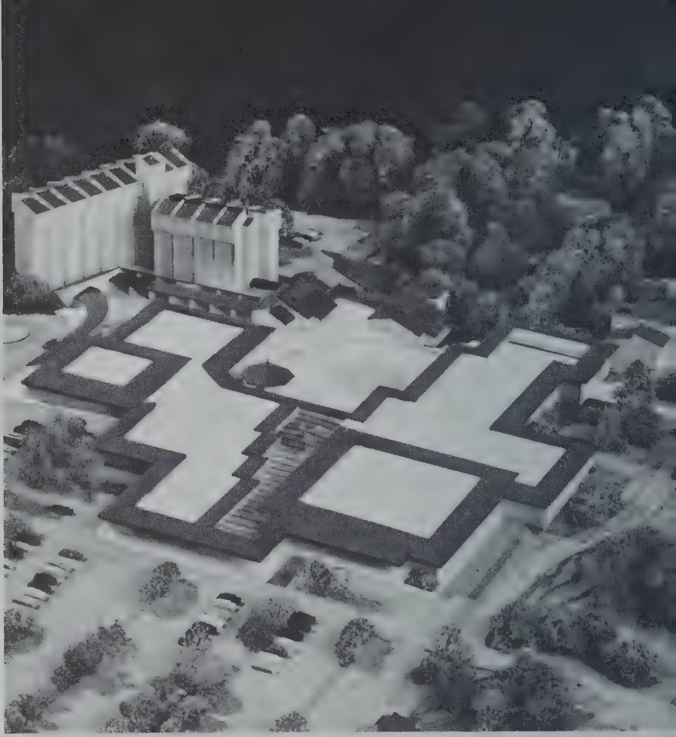


Left—This early and unusual air view of Washington Plaza, Lake Anne Village Center, shows the sidewalk cafe and the landing area for the many types of small boats used on Lake Anne. Shops, a community meeting room, and a branch of the Fairfax County Library ring the Plaza at ground level. Above them are apartments having balconies overlooking the Plaza and entrances through private courtyards on the other side. The open area, left center, now is occupied by Reston's first church. Boutiques, a real estate office, a grocery store, and a bank border the walkway from the parking lot. Part of the parking lot near the main entrance to Reston, left background, recently has been utilized for a two-story block of offices.

Right—A quiet Sunday morning in Washington Plaza, Lake Anne Village Center. All signs in the Plaza add to the architectural interest of the buildings. The gentleman is reading his newspaper in front of the shop at the corner by Lake Anne. As the signs indicate, this shop sells everything from a toothbrush to a snack. Notice the way the apartments above provide shelter for shoppers. Also notice the balconies are partly open and projecting over the Plaza to offer a view of its activities, yet also provide sheltered setbacks for privacy.

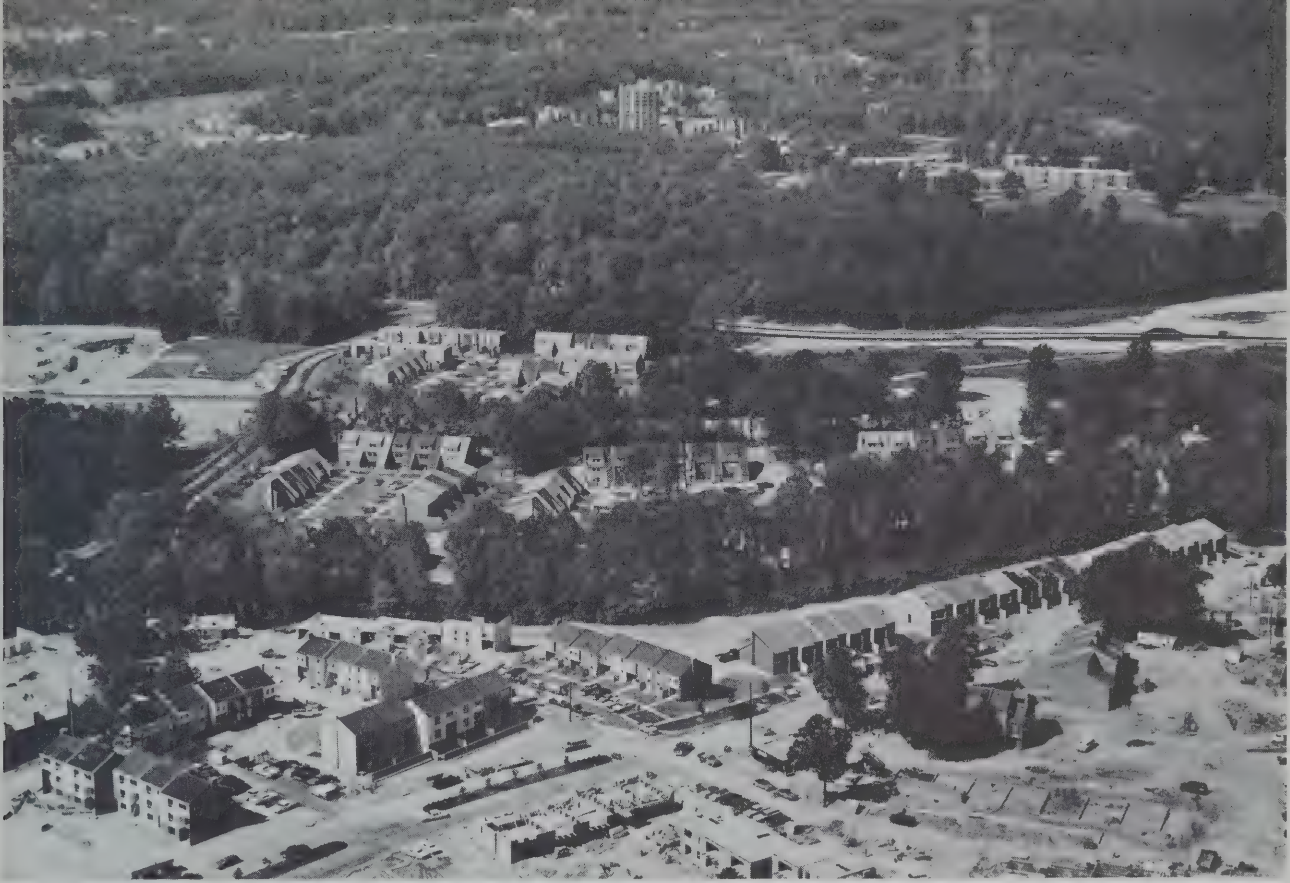
Below—Lake Anne is a 32-acre spring-fed lake that serves as a nucleus for the first of Reston's seven planned villages. This photo is taken from one of the many open-space areas in this first village. Heron House, a 15-story luxury apartment building is on the left. Just visible between trees in the foreground is a portion of the Lake Anne Village Center, with apartments above the shops. On the far side of the lake are a few of the many ultra-modern townhouses in the Lake Anne area. Beyond the trees and houses on the far side of the lake are garden apartments, groupings of single-family townhouses, and Cedar Ridge—the first moderate-income garden apartments built in a new town in the United States under the 221-D-3 program of the Department of Housing and Urban Development.





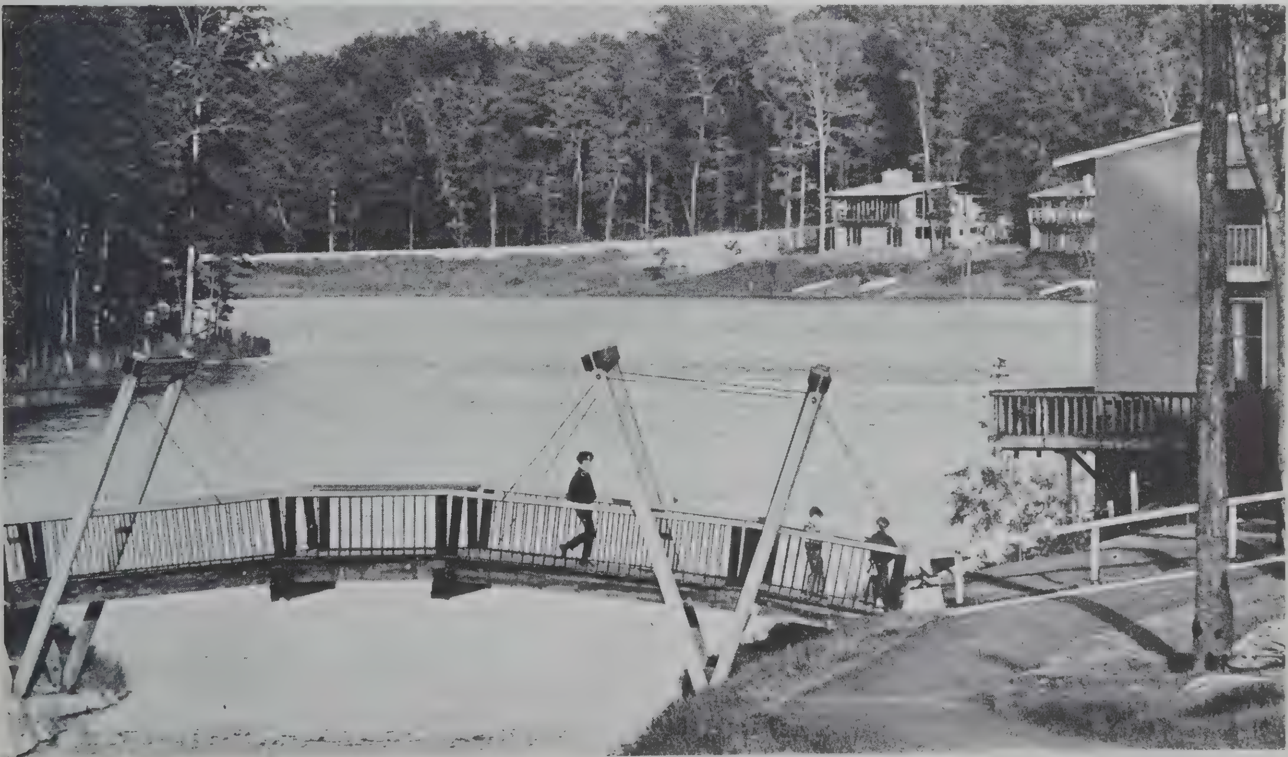
Reston was the first of 20 satellite cities proposed to absorb the major part of Washington's soaring population, which is expected to rise 150% to 5 million in the year 2000. Plans call for future development in a pattern of transportation corridors that would radiate from downtown Washington. Along these corridors would be rapid transit lines. Satellite cities spaced along the corridors would permit the conservation of large wedges of open space, and thus preserve the recreational amenities of open countryside within reasonable distance of the region's 5 million inhabitants. Columbia, Maryland, is another one of the planned satellite cities.

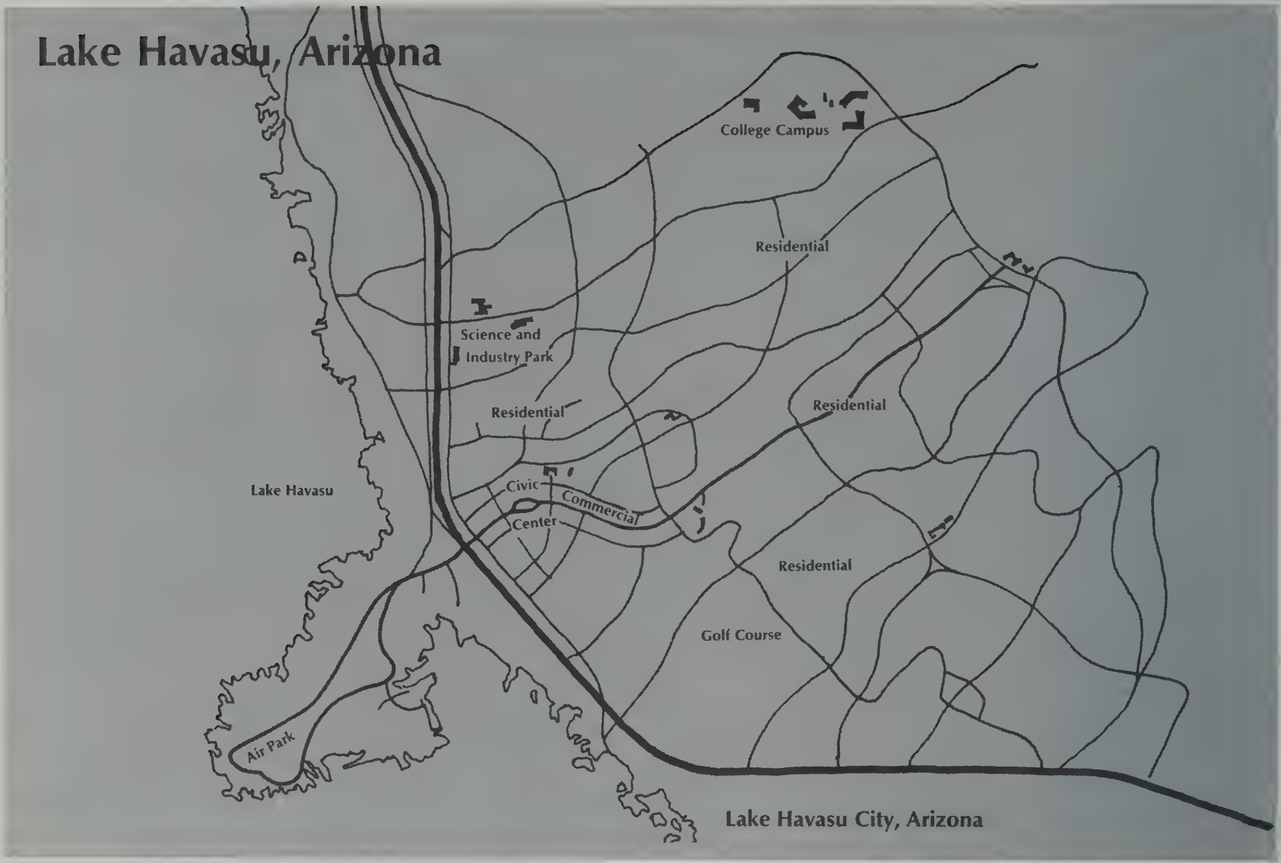
Below—Some rooftops in the Lake Anne Village Center have been landscaped and provide attractive additional open space. This rooftop is used for a kindergarten. Notice the overflowing sandbox, right center! Townhouses and apartments over ground-floor boutiques are in the near background, with Heron House overlooking the entire area.



Above—The foreground of this airphoto shows the new Uplands Section of Reston. When completed, this section will include townhouses, patio homes, and clusters of single-family houses. There also will be some open space, a swimming pool, tennis courts, and an elementary school. In the background is the high-rise Heron House and Lake Anne Village.

Below—Reston has a special walkway system. In the Lake Anne Village the walkway passes under streets, through the wooded and open areas of the village, and over streams (or narrow inlets of Lake Anne as shown here). The walkway system enables children to walk to schools and play areas; it frees parents from complete dependence on the family car, linking residential areas with the shops and activities in the Village Center.





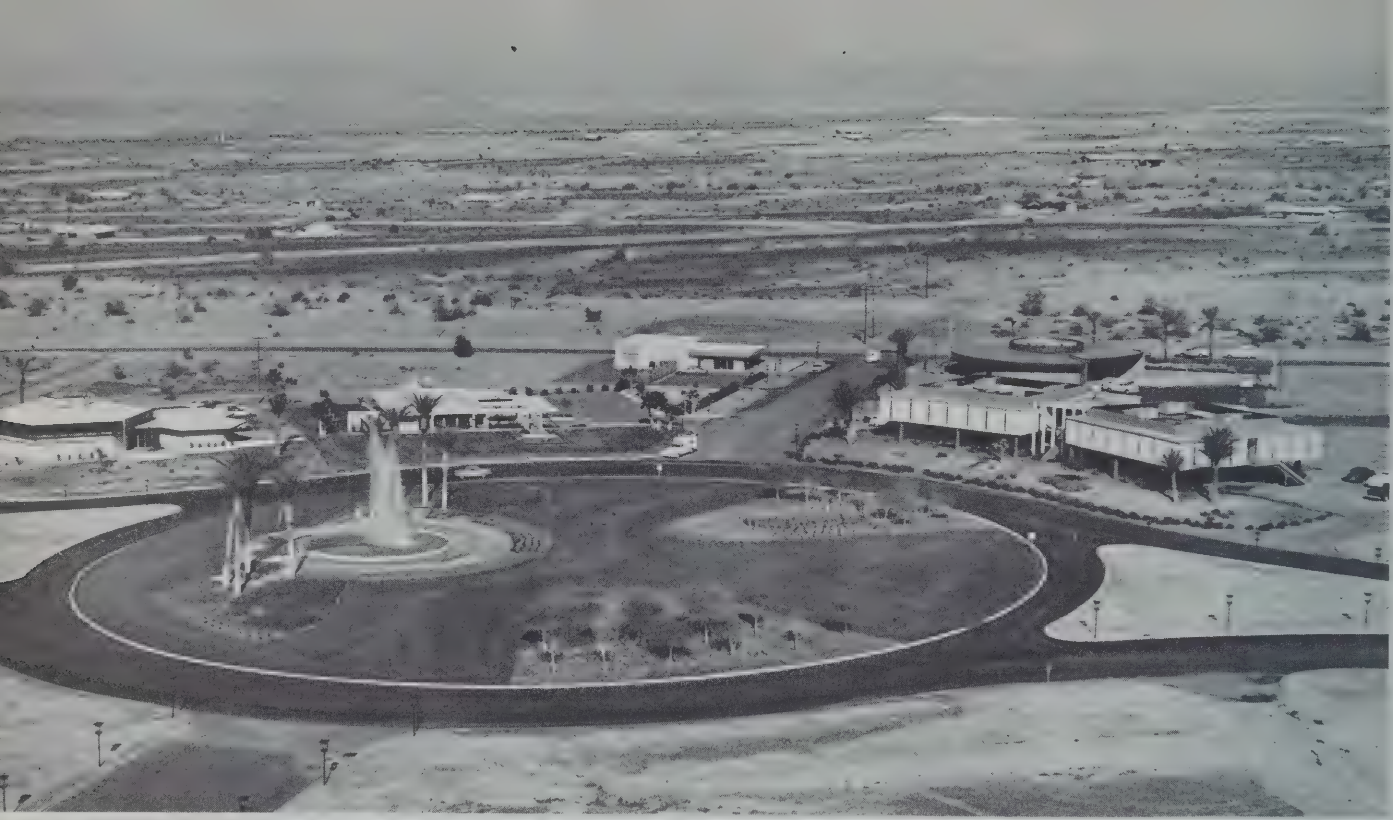
Below—Lake Havasu City Airport provides facilities for commercial flights connecting the new city with Phoenix and Las Vegas, as well as for private airplanes flying in for recreation or business. The city trailer park, needed to house workers brought in to build this city in a totally undeveloped area, is in the middle ground. Lake Havasu and the Mountains are in the background.

Top Right—This sketch shows how London Bridge will look when it has been rebuilt across a mile-long scenic waterway to be created across the peninsula at Lake Havasu City. Near the bridge will be an international resort complex of hotels, shops, cafes, and recreation facilities. Reconstruction of the bridge and dredging of the canal are scheduled for completion in 1971.

Below Center—Lake Havasu City, on Lake Havasu, part of the Lower Colorado River, is a rapidly growing year-round resort and water sports center. This airphoto shows the Nautical Inn, in foreground, overlooking Thompson Bay. Lake Havasu Marina is at the upper left. Lake Havasu State Park beach, one of many beaches in the city, is at the upper right.

Below Left—These attractive, modern gas lamps illuminate many of Lake Havasu's main streets.

Below Right—Shown here are two of several types of garden apartment buildings already completed in Lake Havasu City. A number of single-family detached houses, of various styles, have also been built.



Above—Lake Havasu City civil center buildings are being constructed around an island park. From the left are the library, the water and sanitary district office (behind the fountain), the gas company office, the main post offce (the first circular post office building in the United States), and, in front of it, the professional and office building.

One of the guiding principles in planning Lake Havasu City was recognition of the need for a diversified economic base. The McCulloch Corporation has encouraged other companies to build in this new city. Photo middle center shows the Vernco Corporation of Arizona's 100,000 square foot plant for manufacturing power hand tools for Sears Roebuck & Company; this is one of the largest industrial buildings in the entire lower Colorado River area. Below—Part of the McCulloch Corporation's own plant—the first built in Lake Havasu City. Outboard motors for boats are built in this plant and tested on Lake Havasu.

Open Forum

Mr. Wehrly: It might be worthwhile for each of the panelists to comment on the others' presentations and take exception to them, if they wish. We will then turn the discussion over to members of the audience who may have questions for the panelists or comments upon what has been said.

Mr. Simon: I think it is astonishing that, without our having gotten together privately, there should have been such a cohesive presentation: A rather theoretical beginning; the specifics of a new town as some planners define it; details about Lake Havasu City, which is a new city, really; and then information about another new city.

I would like to say a word about semantics. A new town, I think, is almost an obsolete concept, because basically it stems from the British idea of the green belt. And the idea of the green belt is to separate fairly large-scale communities from others. I feel that, if a community is well enough designed so that it provides for its citizens what they need, there is no reason to insulate it from anything.

I think Lake Havasu City and Chrysler City, or whatever it is going to be called, are new cities in that they are entirely self-contained, whereas a new town depends I think on a central city to which it is satellite.

Mr. Krechter: I think it is mandatory that new cities be built in the United States today. The Department of Commerce and the Department of Housing and Urban Development (HUD) have pointed out that there will be 45 million new Americans in the United States within the next 10 years. That means that 45 million new people have to be housed; 15 million new houses have to be built.

It is important that we recognize we are behind in planning for new communities—whether they be new cities, new towns, suburbs, or existing cities. We face a tremendous problem and we should be laying out a number of cities such as Havasu and Chrysler's new city.

Title IV of the Housing and Urban Development Act of 1968, known as the New Communities Act, emphasizes the fact that there is a crying need for new communities in the United States. The Federal Government has to lend its support to these new communities just as it supported housing construction years ago when the Federal Housing Administration (FHA) was created.

Title IV is an FHA program for land developers. It authorizes the guarantee of loans by the Federal Government to dealers for the installation of off-site improvements, water lines, sewer lines, roads, and so forth.

I should have mentioned earlier that we also have some property in other areas. We have acquired 15,000 acres immediately adjacent to the city of Phoenix. This is almost a suburb of a metropolitan area, but we will plan and develop a self-contained community. This 15,000-acre tract of land, because of its location has three important aspects: We don't have to bring in industry; the the building trades are there, and; a tremendous natural growth exists in the area. We think the town will grow about four times as fast as that of Lake Havasu City, without our attempting to motivate people. We expect about 20,000 people there in 5 years.

We have another project outside Pueblo, Colorado, where development will begin in about 6 months.

We intend to build a new city, a completely self-contained community, every 2 years, with a goal of 100,000 to 150,000 people in each city.

There is a tremendous need for many other corporations to do exactly the same thing. There is a general recognition of the need for new communities, but we as a nation are far behind in realizing what we should be doing.

Mr. Henderson: I would like to amplify what Bob Krechter pointed out. My company is not in business to build cities. Rather we are in business to build and sell automobiles.

But we recognize the problem that new towns are needed and that they are going to develop. Our contribution toward solving that problem is to bank enough of the land in the area of our new plant to preclude a fragmented type of development. A big problem is the lack of direction from the States, local governments, and other organizations, in providing needed information, and institutions and in coordinating the proper planning and financial insurance for developers to come in and build new towns.

I am not thoroughly conversant with Title IV, but I would say that what is needed is FHA-type insurance for the entire town, because it has to be done all at once—the schools, the shopping centers, the city hall, the recreation places, the water supply, and the sewerage treatment and disposal facilities.

Mr. Krechter: I think the Federal Government contemplates a combination of local effort and Federal support in the form of guarantees. The guarantee is for the loan to the developer, so that he can master-plan the area and put in such things as the off-site improvements and also certain public buildings if they are to be owned by the community.

In turn, it also contemplates local government facilities in the form of local water companies, public utilities, and so forth, and it authorizes grants to those agencies to assist them in helping create new communities.

There seems to be a growing trend on the part of the Federal Government—a good trend—to foster and encourage work by State and local governments through grants and the force of the Federal Government guarantee.

Title IV is a new section of the housing law. Bob Paul, who is director of the Section for New Communities, in the Office for Metropolitan Development (HUD), told me several months ago there were 17 areas being considered for guarantees but that they had not really made a decision on any one yet.

One application is for Park Forest South, in the Chicago area. It is for $30 million. I believe the entire Federal program, under the original authorization, authorized $200 million in guarantees, of which no individual guarantee could exceed $50 million.

Mr. Harding (Unidentified questioner): The emphasis in this session, particularly in the last two talks, has been on what is being done to create new cities, starting from scratch.

What is going to happen to your new cities over the next 20 years? What consideration is being given to avoiding the kind of urban problems that you are trying to escape? Or are new towns being built just because of the demands for housing?

Mr. Krechter: I think the most important thing that will help preclude new cities from becoming blighted later is a complete master plan of the entire area.

In the Fountain Hills project outside of Phoenix we have 12,000 acres of land. We have allocated 58 percent of that land for single-family residences, and we know what percentage of that will be developed in what we call high density (three lots to an acre), what will be allocated for one-half to one-acre sites, and so forth. The areas with single-family residential uses will be buffered by areas with multiple-residential area. Because this new community is planned, we will not have a cement plant immediately adjacent to a residential area. In other words, the land uses for the entire area have been planned.

I think preparing and adhering to a master plan is probably the most significant thing that can be done to prevent blight in new communities.

Mr. Henderson: I think this question: "What is being done to avoid future slums such as we have today?" merits very serious consideration.

First of all, I think we should remember the very old cliche that if you do not learn something from history you are doomed to relive it. In my opinion, the problem goes beyond planning and technology. Hopefully, we will have proper planning. But some problems arise even there. The price that you may have to pay for an efficient plan may be some of the very things that you cherish right now, such as your political liberties, which might be completely negated with the enforcement of a good plan.

I would also cite the problem of a highly mobile society, where, within a very short period of time, literally hundreds of thousands of people can move into a very small area. How do you control density? If you start restricting these migrations, you start restricting political liberties.

For example, in Russia certain planning is being carried out. Whether it is good or bad planning I do not know, but it is certainly being enforced with what amounts to a simple order; "You go. You stay." and that is all there is to it.

These problems should be carefully thought out. A deed restriction can be written with magnificent language, but when you go to enforce it the question arises: Do you still have the same type of civil liberties that you started out with?

Mr. Simon: I do not think that the real concern need be the future slums, because we are bound to move forward economically and to continually reduce the poverty level.

I think we should be looking at future communities to live in. High density is certainly one of the problem factors that must be faced. Earlier there was mention of the high density in Lake Havasu City—three units to the acre. I think we should study not only the United States but also European countries. We would find that three units to the acre is extremely low density for an urban society.

I think most people like to communicate with each other. The automobile is not a very convenient way to do that, but walkways are. In Reston there is a dense community with walkways which give the people, and particularly the children, an opportunity to relate to each other, which they just do not get when they have to move by car.

A little story is indicative of what I am talking about. In our nursery-kindergarten in Reston, the children were asked to draw a picture of their daily life. The very sophisticated head of this school came to the office to see me because she said in her experience she had never seen so many children drawing pictures of their fathers. Her rationale for this was that since it was very easy for father and child to get on a walkway and go to some of the little playgrounds, or to the village center, or to some of the areas where there is sculpture to climb on, the relationship became easier and father and child had a greater communication.

So, I submit that any plan that means the citizens are altogether dependent on cars to get around; where community areas are really nonexistent; where people have their own little plot of land and that is all—unless they get in the car—is not good planning. Good planning starts with the individual, his needs, and how he can best achieve a better life.

Mr. Jack Frazier, staff, the American Institute of Architects: A new town may be very nice for a manufacturer of cars, and the company in Arizona is building a new town that looks like a real estate promotion more than anything else. I wonder what you gentlemen are offering in your new towns that would help us solve some of the problems of the old towns and what dimension of social planning you are encouraging. What provision are you making for a mix of people, of jobs, to provide something better than what we have had?

I think you are escaping the problems of the old cities and offering no help to the country at all in your new towns.

Mr. Henderson: I want to make the point again: My company is not building a new town. We have built a new plant so that we can grow and continue to stay in business. We have built this plant in a location where the economic factors are the most favorable.

What I tried to point out is that we have taken care to reserve the land and bank it so that it can be properly planned in conjunction with the State and other government authorities and with good, legitimate investors to develop a good, sound community when that time arrives. But we are not in the business of constructing new communities. And I tried to make clear that I think one problem is particularly apparent—that very few people in the new community business, should be in that business!

In Michigan there is no coordinating agency to guide such installations. In Pennsylvania there is none. And I dare say in most of the other States there is no supra-agency established to guide the development of a new town. I think this is a problem that perhaps a group like this might address itself to. The establishment of such coordinating agencies is needed to accomplish the very thing that you are concerned about.

Sociology and planning are someone else's job, but as an industry we are very much concerned with this. We do not want to create the same kinds of conditions that have been created in many of our urban centers. We want to do our part to make sure that it does not happen again.

Mr. Krechter: It is true that to a great degree we are a lot sales organization at Lake Havasu City. However, the typical lot sales programs are all predicated on the concept of selling a lot with the opportunity of future investment growth; strictly a speculation type thing. We think we are unique in this respect: Our organization is committed to the concept of blending the opportunity for future investment growth with development of the community itself. I think this is attested to by the fact that in 5 years, with what we consider tremendous obstacles (as I pointed out to you, the closest city of any size is 150 miles away), there is now an investment of $70 million in Lake Havasu City. Our assessed value at Lake Havasu City is $12 million which is comparable to the city of Kingman, the only city of any size in Mojave County, which now has an assessed value of $8 million.

The thing that we do, as I have mentioned before, is to completely master-plan the land as far as proper land allocations are concerned. This assures the individual that he will have what we believe will be the proper setting for whatever particular type of lot he may desire to acquire.

The other concept that we have adhered to, is the selection of land which is basically good to live on as far as to the individual is concerned.

Our concept is to create an area where the individual can get outdoors and enjoy recreation without having to drive hundreds of miles. Arizona has the largest percentage of boats per population of any State, and yet there is not a single place in the State, except at Lake Havasu City, where you can rent a slip. At Havasu, you are within five minutes of the water at all times.

Mr. Lewis Manilow, South Developers, Park Forest, Illinois: A question was raised earlier about what will save new towns 20 years from now. I suggest that plans alone will not save the new towns. We built a new town 20 years ago—Park Forest—which now has 32,000 people. There were hundreds of vacancies at one point and it was not the plan that saved us. I think what rejuvenated our new town was the fact that the developer had a vast interest in the community—3,000 rental units. And we spent a great deal of money in our own kind of renewal.

The developers of any new town who are confident that the plan alone will make it forever the beautiful, happy, pristine thing they saw in their original plans, may very well be kidding themselves. I think you have to concern yourselves with the problems of unforeseen events and the structuring of certain types of organizations, public or private, which can deal with those unforeseen events and renew a very beautiful new town.

Mr. Jonathan Foote, Environmental Design Group, New Haven, Connecticut: Mr. Krechter, when you talk about a master plan, you mean roads and subdivisions throughout the entire property in the initial stages of the project; is that right?

Mr. Krechter: It means an allocation of land for various uses such as single-family, multiple-residential, and so forth; with the basic network of roads laid out.

Mr. Foote: But do you have a plan for the entire property with these allocations, as you call them. How many years do you believe it will take you to fully develop the property?

Mr. Krechter: The program of lot sales will occur for about another 2 years—a total of 7 years. Approximately 20 percent of the land will not be sold at this time; these parcels are scattered throughout the property in order to allow for future growth. The most difficult thing of all in planning is trying to determine exactly what is going to occur in the next 5 or 10 years. We have allowed ourselves, if you will, an ace-in-the-hole. We have reserved various lands so if a certain need becomes evident at a later date, we will have land available. The development of the community to the point where we are no longer active in it will take at least another 10 years.

Mr. Foote: The question I am leading up to is: What kind of an organizational entity or decision-making process have you put together to re-evaluate decisions as new problems occur and as you get feedback from efforts that you have made?

Mr. Krechter: I do not know of any specific answer to the question about how the decision-making process operates. You merely feel your way as you are going. You attempt to allocate land uses according to what appears to be proper. You attempt to lay out what appears to be a good pattern for flow of traffic, and so forth.

We don't "develop" the city; we foster the development. We attempt to motivate, attempt to create other people's commitment in the area so that they will make the city grow. For example, only three of the buildings in the town, which are needed for our use, are owned by us. All the rest are owned by other people who have made their own investment in the community.

Another example of fostering development is that we discovered we were very lacking in single-family residential properties, and we found that the local labor force could not cope with the problem. We made an agreement with an outside construction firm to build a minimum of 200, and probably 300 to 400 houses a year in the city for the next 3 years, with the understanding that they could not use any of the local labor force, because we knew that the labor force in the community itself was already overtaxed.

Miss Barbara Cohn, Voit Information Services, San Francisco: What is the relevance of new towns in meeting the social problems of today, when, in fact, especially in the new towns which are in the metropolitan area or just beyond the urban perimeter, the housing usually costs a minimum of $20,000 and goes up from there?

For example, I understand that General Electric is going to build a plant adjacent to Columbia, but no housing will be provided in Columbia for any of the people who work in this plant. Can new communities meet the need for low- and moderate-income housing? Is the provision of such housing realistic? Can anything be done?

Mr. Simon: Well, I know a little bit about what Columbia is doing, and I know a little bit more about what Reston is doing, so let's start with Reston.

In Reston the first 221-D-3 project is probably under construction now and another is planned for Columbia also.

Reston received a $200,000 grant to develop new techniques of building low-cost housing using modularized units from the mobile home field. The report has just been completed. It looks very encouraging. But I think one thing that we have to recognize is that in this country there does not seem to be any desire on anybody's part, really, to build low-cost housing. In the United States, our program has been—and I have objected to it strenuously for over 20 years—to build middle-income housing and then subsidize it for low-income people.

The reason I have been against this is because it seems to me we are not going to get the job done as long as we insist on building middle-income housing for low-income people. For example, public housing in New York City costs $23,000 or more a unit. Conceivably, there will be break-throughs in technology, and maybe the Reston report represents one. This modular development, combined with one per cent interest, will be very helpful.

Beyond that, I think the best program I ever heard of was one developed by Victor Gruen Associates for Teheran, where it was anticipated that over the coming 20-year period the need for low-cost housing would disappear as the economy moved forward. Therefore, the recommended program for Teheran is low-cost expendable housing for low-income people. Over a 20-year period these units will be torn down; on the land on which this temporary housing was built, parking lots will be developed for the car population anticipated for Teheran 20 years from now.

In this way they have what they consider to be a viable program for housing all low-income people in better housing than they have now. This, makes a lot more sense than postulating a program of such extravagance that we will continue to lose rather than gain ground in solving the problem.

Special Guest Speaker

Challenges and Possibilities

by **Otis M. Mader**

The word "architect" has two meanings: One applies to those who design buildings and superintend their construction; the other describes those who plan and then achieve a difficult objective. I trust I will not offend any of you if I choose the latter definition today, for it applies succinctly to each of you, especially in the context of the subject of this conference.

You are aware of Alcoa's involvement in the development of urban real estate. Many of you have seen or at least read about Century City in Los Angeles, which is the largest—and in many ways the most exciting—of our urban developments. It was conceived as a 180-acre city-within-the-city, a self-contained community that would demonstrate the effective result of outstanding planning and design talent. We are developing Century City to make a profit, but seek to do so through a concept that will enrich the lives of those who work and live there, and of the whole Los Angeles community. The degree to which we have met this goal in large measure reflects the contributions of the talented people who have worked on the project.

Today's Opportunity

Today, I want to share with you some thoughts on what I feel to be the most outstanding opportunity that has ever been given the industry. I ask that you share with other key urban leaders a commitment to the cities. I know this is the right time for that commitment.

This is the right time, I believe, because our cities are sick, and growing sicker by the day. The symptoms are all too familiar. In the face of unprecedented prosperity, urban minorities grow progressively poorer—and more militant. Schools grow older and teaching methods more outdated. The air is foul, and water so laden with pollutants that it won't freeze. Bankrupt local governments fight with weak State governments and an absentee Federal Government for a piece of the taxpayer's dollar. Slumlords reign in the ghettos, while public housing is smothered in red tape. Traffic is snarled, and mass transit, with few exceptions, is pie in the sky. Streets are unsafe. Law and order is a do-it-yourself proposition. Millions of Americans continue to flee from desegregated city blocks to segregated suburbs. Their places are taken by immigrants from rural America, totally untrained to work or live in an urban environment.

This is the pattern that forms our urban crisis. Daily it grows more intense. It is in no way limited by size of city—large and small, all are in trouble.

I cannot overstate the potential threat this offers to our whole society and to its backbone, American business. Few businesses of any size can pull up stakes and abandon the city. Their inherent commitment, as evidenced by the urban locations of a large proportion of their plants and offices, gives them little choice but to remain in the city and fight. When the structure of a city collapses, it crushes everything inside it—employees, machinery, jobs, products, suppliers, customers, capital, unions, management, stockholders, and profits.

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There is no greater threat to our economy than the degradation of our cities.

The Cities Can Be Saved

Despite the gloom of many, however, there are many others who have hope. For some, hope comes because they know what the city can be, and can't imagine life without it. It was Socrates who said, "Field and trees teach me nothing, but people in a city teach me much." I suspect that today he would simply observe that the cities are where the action is.

In my opinion it is preposterous to think for one moment that we cannot save our cities—and equally preposterous that we could imagine them not worth the saving. I look at the amazing accomplishments of our economy and of our technology over the past 30 years. I look at our resources of money, manpower, and brains. Surely we can rebuild and restore our cities, and do it with the necessary order, responsibility, and aesthetic values.

I would not be so confident about our ability to redeem the cities if it were not for the many successes our society has achieved.

We have attained industrial might and a production capability without equal in the world, and through it have brought a vast majority of our citizens to a level of comfort and affluence undreamed of throughout most of our planet. We have established, strengthened, and protected the greatest institutions of government for free men ever conceived. We have made higher education a common denominator for literally any youngster with ability and determination. Confronted by specific challenge, we have marshaled the Nation in common commitment to achieve victory in global conflicts, electrify every reach of our country, spread a network of superhighways throughout the land, and orbit men about the moon. We do indeed have the resources and know-how to tackle any task to which our society gives top priority.

We have made great strides of late in starting to meet human problems. We are far from full solutions, but the growing tempo of efforts is most encouraging. One of these efforts is through The Urban Coalition, which I am proud to serve. The Coalition is bringing together key elements of our society—government, labor, business, and other groups—to make common cause in devising programs to solve urban problems. The National Alliance of Businessmen has brought the abilities of the Nation's business leaders to bear on our key social problem—finding jobs for the chronically unemployed. The NAB is providing jobs and training at the rate of 20,000 a month. Whole industries and individual businesses have staked a claim on specific problems, and are applying resources and manpower to help their solution.

The Urban Housing Problem

However, I wish to focus primarily on housing. And our record of accomplishment here is not impressive. Government, through urban renewal, and private enterprise, through its own efforts, have wiped out hundreds of acres of slum housing in the past two decades. These slums often have been replaced by beautiful civic centers, government buildings, parks, art galleries, and highrise apartments. Certainly, all of these serve the public good, but seldom do they serve the same public that was displaced by renewal. Generally, little has been done to care for those who move out as the bulldozers move in. In many cases where public housing was provided, it consisted of bleak, sterile structures offering no warmth and a total lack of community experience.

The dimension of the housing problem staggers the imagination. Just replacing present substandard housing in cities would involve more new construction than the total volume of housing starts in the past 5 years. The 1960 housing census found that more than 4 million urban dwelling units were completely dilapidated, some 3 million more were badly deteriorated, and another 2 million had serious code violations or severe overcrowding. If that is not a bad enough problem, or a big enough market, recent studies indicate the 1960 figures may have underestimated the number of dilapidated units by as much as one-third.

It has been estimated that between now and the year 2000, central city areas will need some 10 million new dwelling units. No matter who builds these units—private operators or public authorities—they will add up to 200 billion of today's dollars in new business for architects, builders, materials suppliers, and others.

Huge as this task is, many companies have begun to whittle away at it—most of them, very frankly, motivated as much by profit as by desire to remedy social ills. But I do not apologize for that. As Henry Ford II once said: "Some may feel it unseemly to mention cost and profit when urgent human needs are involved, but the profit motive is a powerful force. It must be maintained, and it can be used effectively to help the urban crisis."

Indeed, I say that the profit motive is our society's strongest weapon in the fight against the problems we face. All of our wealth is derived as a result of it. And many of the most effective solutions to specific problems result when these can be framed so that profit opportunity is present. Don't misunderstand—making a buck is hardly the sole answer to our needs. But without that buck, a mighty pile of them, in fact, no other answer is remotely possible.

All past efforts, public and private, are overshadowed by the immense job before us. It is a job in which the architect and planner can render indispensable assistance.

Top priority, in my opinion, must be to preserve human values. Or, perhaps, rediscover them. In the great war over housing now ensuing, many special interests are battling over zoning, materials, financing, government regulations, and a whole host of technical matters.

Architects as City Planners

The architect is fit to bear the citizen's standard into these skirmishes. First, you are concerned about human values by the very nature of your profession. In designing a dwelling, you have to consider how it will be used by its occupants. And, second, you can guard against the tyranny of the city by your awareness of the relationship of the parts to the whole. Man cannot live by elevator shafts alone. He has to have an occasional view of a sunset, a cool morning breeze, and a mud puddle for the kids. Many technicians would rob him of those simple joys under the guise of efficiency or public necessity. Indeed, if someone does not stand constant guard, by the year 2000 we may have to go to a museum to see a dandelion.

The architect has come to look beyond his own building sites, and is persuading his clients to do the same thing. The time has come when our environment must be planned, and every city must have a master plan. Many talented architects are entering the planning field. That's encouraging. But they need the close cooperation of architects everywhere if they're going to fill in the white space around their renderings with the shapes of the buildings and parks yet to come. Through such cooperation, the architect can fashion his models so that they fit together with those of his peers to make a city with human values.

I think Charles Dickens was getting at this idea in *The Pickwick* Papers. Mr. Pickwick had a young surgeon friend, Jack Hopkins. The young man felt that an operation was successful if it was skillfully done. But Mr. Pickwick held that it was successful only if the patient got well. Our patient is the total city environment and all who are involved with shaping it have to be concerned with its health after we finish the operation of renewal.

The day has passed when the architect is challenged only with the design of a building. Now he concerns himself with a wide range of social problems, all of which interact with his building. An example of how demanding a responsibility that is, can be seen in a newly opened multimillion dollar development of apartments, townhouses, garages, schools, and shopping centers—conceived as the answer to the housing dreams of 60,000 middle-income people.

But, instead, it has been criticized roundly for dull layout, massive, spirit-crushing architecture, remoteness from vital city services, and total lack of community. "It is an absolute disgrace," one urban planning consultant said, "to continue with this kind of industrialized housing brutality, which is nothing more than a different version of the tenements of the past."

Frank Lloyd Wright once said that a physician can bury his mistakes, but an architect can only advise his clients to plant vines. I am afraid our capacity to build has far outstripped the potential of vines to conceal. We have no alternative to avoiding mistakes.

I cannot qualify to comment on any particular project, and do not appear before you as an architectural critic.

New Solutions Needed

I feel strongly that we must not let new communities become instant slums. And with your help, this will not happen. For you have been taught to weigh carefully a whole host of factors—economic, social, psychological, technical, legal, and aesthetic—in arriving at workable solutions to problems of harmonizing man and environment. And it is all too apparent that new solutions are needed for countless questions. Here are just a few.

How can society fill the gap between the cost of housing and the low-income family's ability to pay? New housing in multifamily buildings costs from $17,000 to $22,000 a unit, even with urban renewal assistance. That means the monthly rent for a $20,000 unit with one bedroom should be about $150. Yet half of the low-income families in the slums can afford to pay only $65 to $110 a month for rent. And the other half cannot afford more than $35 to $60 a month.

Part of the answer may lie in some form of government involvement. In the past few years several unusual financing plans have been offered. They include the turnkey projects now in effect, and proposals for semipublic agencies capitalized with government-guaranteed bonds.

Another part of the answer, and it may be the major part, is to build more economically.

Today you are looking at one specific approach. But while the new town concept—if properly executed—can alleviate some of our growing misery, it will do little to alter the face of existing urban areas.

I suggest that one answer might be to build new towns in old cities. Perhaps we can alter the present urban renewal practices and give people a community inside the existing urban structure. But before we can make this or any approach to the problem, we must know not only what people need; we need to know what they want.

There are many possible solutions, just as there are many problems to overcome. But you are the experts, and your expertise is vital if we are to save ourselves.

Another question: How long can we afford inefficiency? As part of the answer, we must persuade cities to update antiquated building codes that obstruct the use of industry's technological accomplishments. For example, one firm has developed prefabricated townhouse units for garden apartment development. They take every advantage of factory construction efficiency, and require little of that scarce commodity, skilled field labor. But, without major modifications that would raise their construction cost greatly, these units cannot be built in Boston, Chicago, or Cleveland. The reason, of course, is outdated building codes, many of which were written well before the turn of the century.

Even stronger resistance comes from many craft unions violently opposed to change, although there is already a critical shortage of skilled construction labor. There is a spray-on wall plaster that could be a tremendous aid in rehabilitating slum housing. But in New York, one of the most slum-ridden cities in the country, unions have successfully fought its use.

And then there's bureaucratic red tape. There must be faster government approval of proposed projects. Time is money, and no businessman can afford the high cost of waiting long months for a key decision.

But while we're throwing rocks at city hall, let me ask your concern for the man who rides the tiger—the metropolitan mayor. He lacks money and power. But problems he has—in abundance. Every citizen who can get his voice heard must speak up for the need to remove the clots that block the fiscal arteries of our cities.

Technological Innovations versus Available Tools

Let me mention one more area that needs attention. It is a most vital question: How can we encourage innovation, yet kill the myth that new technology will slash construction costs overnight?

It is unlikely that research will find in the near future new building materials that will be markedly cheaper than what we have today. It is equally unlikely that construction labor techniques can be changed dramatically at this time. Yet industry leaders and government officials keep calling for a breakthrough—and this seems to delay a commitment to using the tools already at hand.

The problem is that the bulk of the cost is in land, financing, overhead, profit, interior finishes and mechanical equipment. These areas offer no significant cost reduction opportunities, at least under the circumstances of today. That is not to say that something may not come along. We must continue to search for cheaper and better methods, but we also must get on with the job at hand.

For our part, producers have the obligation to give you all the fruits of existing technology while we proceed to develop new materials and construction techniques so that living spaces can be built better, faster, and more economically than ever before.

If we can build 10 million automobiles in one year, we ought to be able to build 4 million home units. After all, an auto is pretty much like a home. It has furniture, convenience appliances, an environmental control system, running hot water, an entertainment console, and wall-to-wall carpeting. Millions of people are already spending much of their lives in cars. I see nothing wrong with homes built on assembly lines, provided they are well-designed, well-constructed, and fit properly into the total environment.

Your part of the task is to make the best possible use of the wide range of materials and technical assistance already available. We in industry stand ready to support you in any way we can. Do you need a self-contained chemical toilet that can hold a year's amount of waste? We have it. Do you need a furnace the size of a shoe box? We have it. Do you need a low-cost intrusion alarm that is practically impossible to compromise? We have that, too. And what we don't have, we'll develop. Solid electrolyte fuel cells for homes, mini-computers, laser locks, solid-state refrigerators, three-dimensional television, cordless everything, ultra-high-frequency lighting, electronic windows, sound-powered doors—you name it. American business has the technological capability to do just about anything.

I am most sympathetic to the great problem you have of gaining access to all the information and technology already available. And the problem grows more acute as the pace of innovation accelerates. I have no formula for solving your problem—but solve it you must, I am sure you agree. We in industry will work closely to help you answer this growing riddle.

The Possibility for Success

The role of architects, planners, and people in related professions, is changing. You are being called on for solutions to problems so new that even the problems can't be found in the latest textbooks—let alone solutions. You are being challenged to do the seemingly impossible—to turn sterile canyons back into gardens, to bring people closer together without robbing them of privacy, to make life easier without removing its zest, and to help shape the future without restricting it. That's quite an order!

Technology and change have created many problems, and there are more on the way. Technology and change also have produced many potential solutions. It is in large measure up to you to match the two in meeting the crisis of the cities. If you are successful, you will have helped create a mutually beneficial accommodation of man and machine that will rank among the great achievements of the 20th century. □

Techniques of Land Acquisition and Finance

MODERATOR:

Stephen Thompson

I agree with Mr. Garvey's statement that it is difficult in the beginning to assess the very question of whether new towns have succeeded. We don't know what the objectives are. There is an objective for Columbia, there is an objective for Reston, there is an objective for other new towns. But there is no correlation among these objectives. And the government won't be able to impose any control upon them.

Our so-called new towns are not really new towns. There is some new housing; there are new industrial plants, new shopping centers, new medical centers. But as far as I have been able to see, they are simply new appendages to existing cities. To some extent they are parasites; that is, they all depend upon the existence of the original city. Or, if you want to give them a kinder word, they are satellites, or new suburbs. Some of them do take on the characteristics of a new town, but if you take away that central city, they are lost.

Another premise I start with is that developers of new towns are all motivated by a desire to corral the huge profits that result from the development—especially the great increments in land value. And that is the question for our panel this afternoon: How do the developers of new towns acquire land?

Money is the source not only of evil, it is also the source of all progress in this country. Without the profit motives we wouldn't have new towns. The new towns are not designed just to be self-sustaining. Reston and the other new towns were also designed and planned to make a handsome profit for the developers—a profit to which they are more than entitled.

Now, new towns, as far as I have been able to observe, represent an anomaly or a paradox. That is, they are all ventures in what I call private-enterprise governments, or, if you want to use a harsher word private enterprise socialism.

A Town Must Serve a Purpose

To elaborate or explain these comments, let me start with a few elementary facts. I know a Building Research Institute audience is quite sophisticated, but I have found that many sophisticated people still know very little about real estate economies. So I will start off with the simple proposition that every town or city must serve a purpose. A new town or a new city in the middle of the Sahara would serve no purpose, even if it was air conditioned, unless it had developed some special useful function or purpose, maybe for using sand. But people couldn't flourish there—to use an old saying—just by taking in everybody else's washing. They have to be productive. There has to be some reason to have a city in the middle of the Sahara, unless it is a distribution point, a crossroads, or something like that. You couldn't give away Reston houses in the middle of the Sahara and I am not denigrating Reston; rather I am stressing that a city, a concentration of people, has its origins in some natural cause—there is a

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port, there is manufacturing, or there are needed raw materials.

So, except for self-sustaining agricultural communities, new towns are not established in the wildernesses. There are exceptions, I will grant you, but they are always established for a purpose.

Kitimat, in an undeveloped coastal area of British Columbia, is a wonderful new town. But it was built there because of the low cost of producing power for processing aluminum ores to make aluminum.

Brasilia exists because the Brazilian Government decided to put the government operations into a fine new environment up on the plateau in a nice climate. It had a purpose.

Washington, D. C., if you go back to its beginning, was created for only one reason. Its only business and purpose was government.

There was a two-page ad in the New York Times in April—sponsored by a man I had not heard of before who was asking President Nixon and the Nation to set up a program of new cities. He was asking them to create a series of brand-new cities of 250,000 population, each of which would grow to a million in 10 years. But the thing that I couldn't go along with was his statement that these new cities should not be built near an existing megalopolis. I think if new cities are just out in the middle of nowhere they wouldn't be self-sustaining; they would be tremendous flops unless they were related to some productive, useful purpose as a city.

Government Control

In England there are several instances of highly commended new towns. I haven't had occasion to inspect them, although I have visited one—Basingstoke. But we all know the British new towns are commended for their amenities, and for the way they serve the people. There is a reason for this, and I don't find it understood well enough in this country. In England there is absolute national control of all land. It has existed, I guess, since their original town planning acts in the post-war days.

In England, if you have an industrial plant you want to relocate, you can't relocate wherever you want, but only where the Government wants you to build. In effect, you have to get a national permit to build. They will give you a permit to put your plant in one of their new towns, but they won't give you a permit for just any place. You can't go out and buy land and then build your factory on it. Nor can you take your farmland, if you own land in England, and decide you are going to have it subdivided for residential purposes. Land is so scarce that you have to get a permit to put residential development on farmland.

So, in essence, the British new towns are government towns; the government condemns the whole area or acquires it by "required purchase." And so, if some of the British new towns are successful, it is largely because of the coordination or the control exercised by the government.

So remember, when you hear about the British new towns, that, among other things, in their financing there were no great, private developer profits, which are what make the American new towns go.

Now, this brings me back to my statement about our American new towns being ventures, of sorts, in private enterprise government or private enterprise socialism.

What I have in mind when I say that, is that essentially each new town developer wants to use all the typical means of government to reap the prospective profits that have motivated him to start his new town. He started the increase in land values, so he wants to protect himself from imitators building just across the street. He wants a big area or a whole town. Then, in effect, with his controls he becomes his own zoning board. He also has a monopoly on all the gas station sites and all the store sites. He can't afford to have another man across the street giving a franchise or a lease to a gas company competing with the one to whom he gave a lease. He wants all the controls necessary to build an entire community, comparable to a good, socialistic, British new town. In short, he wants to act like his own municipal government—a private enterprise government, or, private enterprise socialism.

In home building and probably in much commercial construction, it is not unusual for the developer's profit to represent, in many cases, no more than the increment in the value of the land. Some developers build only to reap that profit represented by turning raw land into completed subdivision land.

So we have a picture of the prospective developer of a new town. He doesn't go to the middle of Kansas or Iowa. He must look for a site close to some growing metropolis. If his new town is not an appendage to the market provided by that growing metropolis, and if he cannot depend on the purpose for which that city exists—the reason people congregate there—he is finished. So his first and greatest challenge is to acquire land. And he must acquire enough land to be able to control development—and he must acquire it at a good price.

Land Increment Profit

Let me illustrate the profit in land increment by citing as an example, Century City in Los Angeles. I was associated with Zeckendorf, Webb and Knapp who conceived it. It has a hotel, a shopping center, high rise apartments, and office buildings.

Approximately 160 acres were involved. The land was purchased, as I recall, for about $3 per square foot. That would be expensive if you were going to put up single-family houses. But if you develop a tight little city with a good plan, that is not expensive. It cost the developers about another $2 a square foot to put in the utilities. The site had been movie lots; it was not subdivided with an old street pattern. So the developers put in only the minimum of streets, one down the middle and a few winding around. There was no wastage of land for a grid pattern.

They had invested $5 to $6 per square foot for their land. The projection was that when the site was fully developed with a first-class hotel, high-rise apartments, a golf course at each end of the property to protect the values, and with the other fine Beverly Hills housing on each side of it, the average value of the developed land would be $20—or an increment of $15 per square foot.

After allowing for the street there were perhaps six million square feet of land. Multiply that by $15 a square foot. The increment in the land value alone was approximately $90 million. This didn't count the potential profits for contracting for the buildings, or the profits of operating the facilities.

The problem, of course, is how to realize that profit. How do you get $90 million land profit out? It is like paper profits on stock. Sometimes you have to sell to realize it. Or, if the hotel was refinanced after it was up and in operation, and you got 100 per cent financing, you would get your money out through the mortgage route. Or you could sell it on a purchase lease-back, or sale lease-back. But to realize the profit you would have to put in half a billion dollars worth of construction. And of course this isn't done overnight. It takes time.

The unit figures for the new towns to be discussed now will not be as high as the Century City land figures, of $15 a square foot. You may only have an increment from $1 to $2, but if you have 20 million or 30 million square feet times $1, there is what makes a man go out and plan a new town. And he is not thinking of what the Department of Housing and Urban Department wants him to do, and he is not thinking of a national program for new towns. He is building for that buck. Money makes the new towns go round, if they are going to be built. □

Techniques of Land Acquisition and Finance for Columbia

by **William E. Finley**

It is shocking that a nation with our affluence allows today's slums and sprawl. Both are likely to grow worse unless parts of existing towns and cities are rebuilt, suburbs reorganized, and new towns and cities constructed. Intensive and extensive action is needed now; the time for purely theoretical discussion has passed. I am convinced that Columbia can and should be a forerunner to, or a prototype of, the hundreds of new towns and cities necessary to house the forthcoming generations between now and the year 2000.

Are New Towns and Cities Really Needed?

In my opinion, new towns for the United States are too little and too late. Columbia and Reston are very good early pioneers. They are Model T's. I think we now need 1975 Lincoln Continentals. It is estimated that by the end of this century the population of the United States will increase by 100 million. These people must have a place to live.

I believe that 50 percent of the next 100 million increase in population will be accommodated in peripheral growth around existing cities. For expansion on this scale it will be necessary for cities and their suburbs to be renewed and expanded by design—not chance. Today's city slums and suburban sprawl are ugly, inefficient, and inhuman. By remodeling and reorganization, existing cities and suburbs can become beautiful, efficient, economic, and livable for both their present inhabitants and the millions of people who will live there in the 21st century.

I think that no more than 10 per cent of the anticipated growth will be in small towns and rural communities. The remaining 40 percent will require the development of a large number of new towns and cities.

A Critical Issue

The question about frontiers or failures is a critical issue. Most properties large enough in area to be called new towns or cities are accidents of ownership. The land in most of the places that are being promoted as new towns happens to have been owned by the people who are developing them.

Land assembly is a critical problem. With the exception of a few lucky breaks possible in the next 10 or 15 years, I don't think it is possible for private enterprise to assemble sites for the needed new towns and cities. If they are assembled through private enterprise, they are likely to be in the wrong locations. The new cities have to be beyond commuting distance of existing metropolitan areas. Places like Chicago should not be any larger. And, as a man who spends one day a week in New York, I can tell you that I am convinced that it is at a point of unlivability.

Land must be assembled through one of a half-dozen techniques that could be devised at a conference such as this.

New financing techniques are imperative. These might include Federal financing of State, regional, county, or municipal development agencies, a *la* redevelopment. The redevelopment program in

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the United States is neither all successful nor all bad. The machinery, in terms of public and private financing, is structurally proper. For new city development, there must be long-term loans at below market terms, or extremely patient money—at least 10 years. I don't think any self-respecting new city can show a profit in less than 10 years.

There is the need for the United States to move toward a national program for new towns, new cities, and new metropolitan areas. There are going to be some difficult matters in financing, in development strategy, and in industrialization, but I think the development of new towns and cities is the only worthwhile alternate to making the biggest 25 urbanized areas in the United States unlivable. And they may become unlivable in the few years between now and the year 2000 if we are not careful.

Determining Location

Technological changes have freed today's new town and city site selectors from many restricting criteria. Basic transportation and communication networks; distance to power and water supplies; and problems of construction and difficult terrain and soil still are important, but they are less restrictive than ever before. Among the major new criteria becoming important are those relating to environment—including climate, access to usable open space, and aesthetically pleasing topography and vegetation. The opportunity for developing a sound economic base remains an important factor.

The Rouse Company is a mortgage banking and real estate development firm. It finances apartments, regional shopping centers, and office and industrial buildings built by hundreds of real estate developers throughout the United States. The firm also builds, owns, and manages such properties for its own account.

From these experiences James Rouse has become increasingly aware of the problems caused by disorganized urban growth and the improvements in economic value, convenience, and community life that result when parts of a city are arranged to complement one another. He and members of his firm began to ask themselves questions such as: Couldn't residential areas; schools and churches; shops, offices, and industries be arranged so that each would give strength and value to the other? Couldn't all this—a whole new city—be fitted on the land so that hills, forests, and stream valleys would be preserved and give shape, separation, and identity to communities within the city? And couldn't such a city be beautiful, human, and also profitable to build?

Based on the premise that a good urban environment must function efficiently and should provide optimum choices in meeting the needs and desires of people living there, it was determined that the minimum size for such a city is 100,000 people. This population would support both the necessary economic base and the usual social functions.

This city would need approximately 12,000 acres of land. But where should it be located?

Columbia's Location

A number of sites were considered in seeking a location where 12,000 acres of land could be bought on the open market, at a nonprohibitive price, in an area where a new city of this size could be economically feasible. The location selected was midway between Washington and Baltimore in a predominantly rural area of Howard County, Maryland.

Growth potential is important to developers of a new city. The site selected is excellent. Nowhere else in the United States are two cities as large as Washington and Baltimore so close together. From center to center, these major cities are 37 miles apart. The beltways which ring these cities are only 20 miles apart.

More than 1.7 million people live within the political limits of Washington and Baltimore, and another 2.7 million live in the sprawling suburban areas outside these cities. The combined population of their metropolitan areas is 4.5 million—and it is one of the fastest growing regions in this country.

Along the major routes connecting these cities lies the rapidly growing Washington-Baltimore corridor. As both Washington and Baltimore continue to spread outward, this corridor will continue to absorb a large share of their growth. Columbia lies in the path of growth from both directions. It is in an ideal location for a new city to serve, grow with, and complement the region.

Transportation in this area is very good and soon will be excellent. Beltways around both Baltimore and Washington, together with three highway routes between the two cities, provide excellent connections to the Columbia area. Driving time from Columbia to Washington is 40 minutes; from Columbia to Baltimore, 30 minutes. Friendship International Airport is within 20 minutes, and the deep-water harbor of the Port of Baltimore is within 30 minutes. Interstate highways connect Columbia with all of these facilities.

Industry in the Baltimore-Washington corridor is strong and diversified. All the elements of location, market, accessibility, skilled labor, and existing scientific, educational, and research bases form an unparalleled blend of opportunity.

The area's advantages as an industrial location have already been recognized. More than 65,000 people are now employed in primary industries and agencies in the corridor. Westinghouse, IBM, General Motors, W. R. Grace, and other companies have chosen the corridor for major facilities. It is also the home of the John Hopkins Applied Physics Laboratory, Goddard Space Flight Center, the Naval Ordnance Laboratory, the National Security Agency, the Beltsville Agricultural Research Center, and other plants and government agencies.

Altogether, within 40 minutes of Columbia there are more than 500 companies and organizations, almost two dozen colleges and universities, and the headquarters of scores of Federal agencies.

Land Acquisition and Initial Financing

The accessibility and the growth rate of the Baltimore-Washington corridor were important factors in selecting the site for Columbia. In addition, there was an adequate amount of available, undeveloped land. In fact, most of the area was still in farms. Because the pressures of urbanization were just beginning to be felt, it appeared possible to acquire the needed land for $20-$25 million.

In mid-1962 an option on 3,000 acres was taken. Then, in September 1962 James Rouse of Community Research and Development, Inc. (CRD) discussed with Frazer B. Wilde, then chairman of the board; James H. Torrey, in charge of investments; and others of the Connecticut General Life Insurance Company, the values of building a new city and the investment possibilities such a city would provide. Costs, timing, and many other problems were considered. Jim Rouse told Connecticut General representatives that he had the nucleus of a staff capable of planning and developing a new city and options on 3,000 acres of land, but it would cost $20-$25 million to buy the 12,000 acres of land needed for a city. He also stressed that no one single real estate developer has the financial resources to develop a new city, that the usual borrower-lender relationship would be inadequate, and that a totally new relationship would be needed.

The Connecticut General Life Insurance Company examined the concepts and purposes of Columbia, and agreed with the principles, promise, and potential of the new city. Jim Rouse proposed to Connecticut General that they put up all the money for land and acquisition and that we (CRD) put up all the money for planning and zoning; preliminary engineering; and public relations to get zoning, water, sewer, and highway approvals. He proposed that with their $23.5 million, and our one million dollars, we be equal partners. Connecticut General agreed that was a wise compromise—that we do the work and they provide the major share of the money. I cannot over-estimate the amount of work that was involved.

One of the important elements of that financing had to do with the point that once we obtained planning approval, zoning approval, water, sewer, and highway approval, we would then obtain an additional X million dollars which would be needed to launch the community. This turned out to be another $25 million or so, and we did obtain it.

The terms of the financing were very important. The basic term, aside from the interest rate, which at that time in August of 1965 was not onerous, was the fact that there were no payments of principal or interest for 10 years, even though the economic model indicated that the project would be in the black by the seventh year of development. That kind of financial statesmanship is not common. Connecticut General is an amazing and wonderful company. They are leaders in their field in almost every way. They could see that a Columbia at its location—with us working our heads off, and with their money—was going to make a contribution to urban America. And the worst thing that could happen to them is that they make a lot of money. Who could go wrong by owning 14,000, at that time, and now 18,000, acres of land half-way between two of the fastest-growing cities in the United States, only 37 miles apart from White House to City Hall?

I raise this point only because of the importance of the wisdom and breadth of comprehension of lenders. In the last 3 years, fortunately, an amazing number of large-scale insurance companies and other organizations have chosen to move into this field. It is a good thing. But Connecticut General was being very adventuresome in its commitment to us in mid-1965. Connecticut General covered the options on the 3,000 acres of land.

A jointly owned land holding company—Howard Research and Development Corporation—was formed; half is owned by Community Research and Development, Inc. (now the Rouse Company) and half by Connecticut General Life Insurance Company. Connecticut General then loaned $23.5 million to this company. The money started flowing into HRD in the winter of 1962-1963.

Land acquisition was intensive from February 1963 through summer 1963. In that time approximately 15,000 acres of land were purchased in more than 140 separate transactions; 13,690 acres were to be included in the new city. The land was acquired at slightly less than the agreed upon price of an average of $1,500 per acre. Almost all of the land acquisitions were handled by one real estate man—who never knew for whom he was buying the land until the week before James Rouse announced to Howard County Commissioners his land purchase and his intent to build a new city.

The land we had bought was approximately one-tenth of the area of this predominantly rural county, which at that time had a population of less than 50,000. The county had a policy of "stop urbanization." We had to convince the county officials—and the county citizens—that our goals for Columbia were a desirable alternative to the scattered, sprawling urbanization that was otherwise inevitable in this county in the burgeoning Baltimore-Washington corridor. In anticipation of the rezoning that would be needed, we immediately began to communicate to the county officials and citizens our goals, ideas, and plans.

Columbia is an integral part of Howard County now. It is planned to remain part of the county rather than to incorporate as a municipality; this is consistent with Maryland's laws and traditions.

Timing

"Time and money" is not a trite statement to the developers of a new town or city. Carrying charges on borrowed money and taxes on the land must be paid whether or not there is cash flow from land and building leases. Because HRD bought the land for Columbia in advance of the basic planning, carrying charges and taxes were paid while planning was in progress. Some of the land will have to be carried for as long as 15 years before it is developed; other land is to be retained as open space.

The economic model is another critical influence on planning. This complex series of projections and conjectures shows when and how the investors are going to get their money back and when they can expect to make a substantial profit. The economic success of Columbia depends upon a delicate balance of cash outlay and development pace. The economic model, updated four times each year, is used to coordinate expenditures and timing of construction work of many kinds—from roads and sewers to apartments and industrial buildings, including land sales to builders and leasing of HRD-owned buildings in the residential, shopping, office, and industrial segments of Columbia.

The design and timing of construction of basic utilities also influence what can be done in a physical plan for a new city built on raw land. One year was allocated to prepare and present an acceptable development plan and financial program to Connecticut General and to Howard County.

County officials knew that if the development approvals for our proposed new city were not received, we were in the position of having invested the money with enormous courage and that we were going to have to do something with the land. The real question before them was: Was our alternative for development better than the one they were presented with otherwise, in the case of a county which was being nibbled at by urban growth from both the Washington and the Baltimore edges? Which would be the better quality of urbanization?

Additional Financing

As was mentioned earlier, we knew from the outset that additional funds would be needed for the development of Columbia after planning, zoning, and other approvals were received from Howard County. The Teachers Insurance and Annuity Association of America and the Chase Manhattan Bank together matched Connecticut General's investment. This brought the original financing to $50 million.

As Columbia proves economically viable, the large pools of private capital found in pension funds, insurance companies, banks, and savings and loan institutions, are able to see that they can get a competitive return for their investment. A large number of other investors have provided conventional mortgage loans on individual properties.

In Conclusion

New towns, new cities, and new metropolitan areas are needed. The many aspects of building them will offer a multitude of new frontiers which will be in:

- Federal leadership to provide national policy guidelines for urban growth.
- Federal assistance to provide to public, public-private, or responsible private development groups, by grant or long-term loan, the very large sums of money required during the early years of new town and city land acquisition, planning, development, and operation.
- State and regional leadership to establish policies regarding new towns and cities.
- State leadership in establishing State, regional, and/or local public development agencies or corporations to guide the location and development of new towns and cities.
- State leadership in use of existing Federal and State programs to encourage and assist the deveploment of new towns and cities in the selected locations.
- State and local acquisition, planning and maintenance of open-space lands needed around new towns and cities to preserve their identity and integrity from encroachment by parasitic growth.
- Federal, State, and local aid for special education, job training, and family counseling, as well as subsidized housing to help people willing and able to move from city ghettos and rural slums to the new towns and cities.
- Semi-private and private agency assistance in establishing new community institutions.
- Private sector investments by financial groups in mortgages for housing, shops, and offices, as well as for industries.
- Corporate and individual commitment to community growth and improvement along with their investment in an industrial or office building, shop, house, or apartment.
- Commitment by the new community developer—whether a public agency, public-private corporation, or private corporation—to build a real and complete new town or city, to respect the ecology of the area in which he is building, and to provide the best possible environment for the growth of people. ☐

Finance and Land Acquisition for Snowmass

by **R. L. Herberg**

From my point of view, the characteristic that differentiates a new town from other large scale real estate developments is its self-contained, fully integrated nature. It has its own newly created basic industry, social resource, and complete community infrastructure. Because moving to a new town involves several major changes in a family's situation (as compared to moving to a suburb or buying a second home), settling of a new town is slower than the sell-off of a tract of lake-oriented lots to leisure-minded small-time land speculators. A new town's complexity requires a more expensive organization in order to carry this out successfully. This, added to the huge expense of creating the new industry, the social resources, and the community infrastructure, together with a longer term of development, makes new towns a less profitable form of real estate development.

As a result, it is imperative that carrying costs of the project be kept as low as possible. By carrying costs, I refer to the problem of keeping the cash invested low enough in relation to net income so as to realize a satisfactory return on investment.

Many factors affect the cash requirements of the project. One that is established earliest, and which is also one of the largest factors, is the way in which the raw land is bought and financed.

Land Acquisition for Snowmass-at-Aspen

First, I'd like to give you a brief background about the land acquisitions made at Snowmass-at-Aspen and then relate to you what I think we've learned in the process.

Back in 1958, following Bill Janss' decision to try to develop a new ski resort, he began to acquire land. Certain decisions he made were very important. They were made either intuitively or were circumstantial, because there is no evidence of any analytical work having been done, or of anyone else in the company being aware of what he was up to. Nevertheless, his selection of a location had the following characteristics vital to success: **1.** nearness to an internationally known and established ski resort; **2.** two large mountains with low development cost characteristics and a vast amount of terrain suitable to the intermediate-skilled skier (the bulk of the market); **3.** large amounts of developable ski-oriented fee land available for purchase; and, **4.** timing of land purchases just before the growth of skiing in the area.

Over a 7-year period, Bill Janss bought five ranches totalling approximately 3,300 acres. He did it by getting acquainted with the ranchers, using a patient, low-key approach, and disclosing his purpose. He made the purchases himself with the aid of a local attorney. Although he might have paid slightly over market price for the land, the terms of purchase were advantageous to long-term development.

That is what I inherited. Since that time I have made two purchases: One, a 70-acre parcel right in the heart of our property, which had always been priced too high for Bill; the other, an 8,300-acre ranch with 4 miles of boundary common with our own holdings. We subsequently resold all of this ranch except 100 strategic acres.

This latter transaction represents achievement of the classical real estate development strategy. Whenever a developer makes improvements to his own property, he not only increases its value, but also the value of his neighbor's property. Assuming your own land is adequate for your needs, the optimum strategy is to option surrounding property before improving your own and then resell the surrounding property after it has been increased in value. The profit on the transaction just described will be almost equal to American Cement's original investment in Snowmass-at-Aspen.

R. L. Herberg is President of Snowmass American Corporation, Aspen, Colorado. He was Industrial Management Engineer for Ryan Aeronautical Company for a number of years before joining the Janss Corporation as Production Control Manager of the Land Development Division in 1963. He has been General Manager of Snowmass-at-Aspen since 1965.

The interesting thing is that nobody loses. We paid more for the land than it would have been worth without our development. We sold it for more than we paid, because in the interim our development became a proven success. And, in the near future, the land will be worth more than we sold it for.

Three Important Aspects of Land Acquisition

Three important aspects of the land acquisition process are: (1) the property rights received, (2) the preparation leading up to negotiating the land purchase, and (3) the terms of purchase that ought to be considered. There is much more to land acquisition than will be covered here, but these points are the most relevant to new town profitability from what I have learned in my part of the country.

Property Rights

The value of your land purchase involves more than acreage, location, and beauty. There are other property rights that significantly affect the value of the land.

Land without domestic water is useless for development purposes. Therefore, you must be sure adequate water for your development is available either with the land or separately.

Much of Colorado land is encumbered with mineral claims. Mineral claims can make the land unfinancable and possibly unmarketable if you cannot prevent surface entry for mineral exploration. Therefore, the developer should get all the surface mineral rights with the land.

In rural America, title to much property is clouded by adverse possession. Adverse possession is difficult to detect. You should be wary of adverse possession and provide in the deed you obtain for the exclusion of any adjacent property the seller may have by virtue of adverse possession as well as recognizing circumstances that give land you may think you are getting to someone else by right of adverse possession.

You must assure yourself that the property has adequate access from public roads to satisfy your purposes.

Property may also be encumbered by right of way, ditch, or utility easements that might prevent your development plan from working. Get these cleared up if you can.

Avoid allowing the seller to keep a small "homestead" in the property. That piece will hamper your plans and be a thorn in your side forever.

Preparations for Negotiation

If the process of determining location has not produced it, then the following knowledge should be developed in order to structure the land purchase terms effectively.

1. The purpose for which the land is being acquired obviously must be considered. What kind of development will it be? Who is the market for the product?
2. The quantity of land needed to achieve the purpose of the development must be determined.
3. A crude master plan is needed as a basis for determining which land is needed—and the probable land uses.
4. A feasibility analysis should be prepared, based on the master plan, considering improvement costs, overhead, land cost, land uses, probable market prices, and probable absorption rates.
5. The master plan and the feasibility study should show how much you can afford to pay for the land; they should also result in detailed knowledge of the desired property and the neighboring lands, so as to understand their relationship to the proposed purchase lands.
6. Identify land you are certain to want, which you might want, and which you do not want but which will benefit most from your development.
7. If these lands are under separate ownership decide the sequence of negotiating for them.
8. Get as much title information as possible so that you can anticipate problems and specifically provide for them in the initial negotiations.
9. You have to resolve the trade-offs between fixed obligations (usually coupled with lower final cost) and less fixed obligations (usually coupled with higher final cost). This is influenced by your confidence and your capital structure.
10. Try to learn the purposes and motivations of the seller.
11. How you approach the seller depends on a variety of different circumstances applicable to each case. If he knows your purpose, then one of your most important jobs is to convince him that:
    a. You offer the best means for him to obtain the highest value.
    b. That you will do a quality job in developing his property—most owners have a paternalistic feeling toward their land and also seem to sense that a quality developer needs the seller's help in setting terms that make quality development possible.
    c. That new town development is not as profitable as may be popularly believed.

Terms of Purchase

Within the foregoing criteria, the purpose of the negotiator should be to minimize the carrying cost burden of the land being acquired. What is ultimately achieved is a function of the relative skills, knowledge, and positions of the negotiators.

In Colorado, the best financing is available from the seller, so it is assumed here that financing is obtained via the purchase terms.

The basic terms which we will consider are: price, down payment, terms of note, form of payment, interest rate, release provisions, prepayment provisions, and flexibility rights. These terms are interrelated, and no single term can be considered by itself without assuming all other terms are constant. For example, when using the discounted cash flow (D.C.F.) method of analysis (as most developers do), wherein the present value of all future cash income is measured via a target rate of return against the present value of all cash invested, a cash purchase price of $100 per acre may be equal to a purchase price of $300 per acre under certain terms.

Once you have determined which of the terms is most important to the seller, you should establish via negotiation that term as low (or desirable) as possible and then see what you have to do to the other terms in order to meet your own present value cost objective. All other things being equal, the price per acre should be as low as possible, the down payment as low as possible, the term of the note as long as possible, and the interest rate as low as possible.

The best deal I have ever heard of in our area was one wherein the buyer had a long-term option to purchase any amount or part of a 1,500-acre ranch for $1,000 per acre, but he had to buy at least 50 acres per year to keep the option. This essentially gave the buyer 30-year interest-free terms. Discounting the selling price back at an 8% rate gave the land a present value of only $375 per acre. As long as the buyer could merchandise 50 acres per year, and as long as the residual value of the developed land exceeded $1,000 per acre by more than enough to cover the interest cost on the improvement dollars invested, the developer could make an infinite return because he need only buy the land as he had it already sold.

On our ranch purchase deal, we lowered the carrying cost by reducing the nominal purchase price per acre and giving a profit participation with a buy-out provision at the (higher) effective acreage price. The result is a smaller note face amount (until the buy-out is exercised), which reduces the interim annual principal and interest payment.

One of the problems with subdivided land sales is that the developer takes paper for a large part of the selling price, but pays cash for much of the improvements and all the land conveyed. This causes a negative cash flow and reduces the D.C.F. return. We reduced this problem by getting the right to substitute at par notes taken on resale of the land for 75 percent of the cash payments due the original ranch seller. This is equivalent to selling the paper at par.

The provisions for releasing land from the purchase deed of trust have a strong effect on the carrying cost for the land. The objective is to be able to release as much land from the deed of trust as possible for all principal payments including the down payment. This is usually based on a higher price per acre than the purchase price. The best we've done is the same price per acre as the purchase price and getting release credit for all principal payments including the downpayment.

Flexibility in location and quantity of land to be released can affect carrying cost too. If the release provisions force the developer to take too much of a kind or location of land for which he has no immediate need, he may be forced to make prepayments in order to have released land he needs.

This increases the land investment and reduces the D.F.C. return. Here is an area where the terms imposed on the seller cannot be too onerous; the courts have invalidated some sales because the seller was not adequately protected by a method of establishing what parcels could be released.

Water rights are a special problem in Colorado. Domestic water supply comes from conversion of irrigation rights to domestic rights. It is best to avoid putting the water right under the deed of trust because the provisions for getting them out are very complex and insecure. It is important, if the water is encumbered by the deed of trust, to obtain the right to adjudicate and hold transfer proceedings necessary to develop the domestic water supply without paying to get them released from the deed of trust.

It is vital to have the right to prepay on the note in order to get land released to keep pace with your rate of development. This should be done without penalty. On two of Bill's early purchases we had to re-negotiate prepayment privileges. As a result, those prepayments have more strings attached to them than need be.

Other Factors to Consider

In addition to the terms just mentioned, it is a good idea to try to think of all the peculiar things you might want to do, so that provision for doing them can be negotiated into the deal.

Land acquisition is a part of the development that deserves a lot of thought, otherwise the deal you make may come back to haunt you for years to come.

In view of our population growth and the problems of our existing cities, the quality development of new towns is a socially important business venture. Profitability is the big obstacle to successful new town development; therefore, I have focused on those aspects of land acquisition that relate to profitability. ☐

Land Acquisition for Lake Havasu City

by **Robert G. Krechter**

The acquisition of financing of land by McCulloch Properties for Lake Havasu City, Arizona, has been accomplished in two ways: (1) negotiations with, and acquisition from, State and Federal agencies; (2) negotiations with, and acquisition from, private individuals.

The land acquired at Lake Havasu City was assembled in two parts. The first consisted of the acquisition of 3,500 acres of land, and this acquisition was relatively simple. The land was purchased for cash from a group of individuals who owned all the land in question. Unfortunately, however, the 3,500 acres of land acquired were not contiguous, but rather constituted all or portions of odd-numbered sections of land in the vicinity of what was then known as Site 6, a fishing resort on the Colorado River. Originally, this land had been acquired from the Federal Government by the Santa Fe-Pacific Railroad Company, as consideration for the extension of railroad lines westward. The agreement originally approved by Congress authorized the granting of every other section of land for 25 miles on each side of the right-of-way. Subsequently, the Government reacquired all but the 3,500 acres of land that later was acquired by McCulloch Properties.

Obtaining Land from the Federal Government

The foregoing, and what happened subsequently, can generally be classified as a saga in the frustrations of obtaining land from the Federal Government. In order to fill in the checkerboarded holdings of our corporation and acquire enough additional land upon which a city of a reasonable size could be constructed, it was necessary to determine the methods by which the Government could dispose of Federal Land. At the time, three methods were available:

1. **Public Sale.** The law under which a public sale could be held at that time limited the area to be sold under any one sale to 1,520 acres, if the public land was isolated or disconnected, or 760 acres if the tract was not isolated and the greater portion was mountainous or too rough for cultivation. Because we were interested in acquiring approximately 13,000 acres of land it would have been necessary to have arranged for a series of such sales—a route that seemed extremely hazardous because of the exposure of the sale of one of the parcels to some other person, thus creating a void in our master plan.

2. **Private Exchange.** Pursuant to the provisions of the Taylor Grazing Act, it is possible to effect an exchange of land with the United States Government, if the offered land is desired by the Federal Government, the selected land is not required by the Federal Government, and the value of the offered land equals or exceeds in value the selected land. This course is fraught with danger, because you must first determine that the Government is

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indeed interested in acquiring the land you wish to offer, you must have title to the land or a firm option to acquire it, and you must obtain an appraisal acceptable to the Government so that it can determine that the offered land is equal to or greater than the value of the selected land. The latter point is particularly difficult, because the Government will not accept the appraisal of a person retained by the individual—even though the appraiser is a Member of the American Institute of Real Estate Appraisers (an MAI)—but will either appraise the property with its own staff (which usually involves extensive delays because of heavy backlogs) or will commission an independent appraiser to perform the task. Further, the Government will rely entirely upon the appraisal given by its own department or its own selected appraiser—there appears to be no method of compromise. Finally, on February 14, 1961, there were so many pending applications and petitions for public land that the Secretary of the Interior placed an 18-month moratorium on all new applications to allow the Bureau of Land Management adequate time to clean up the backlog. Because of the foregoing, it was obviously not appropriate for us to consider an exchange.

3. **Acquisition by the State of Arizona.** The enabling legislation passed by Congress authorizing the granting of statehood to the territory of Arizona provided, in effect, that, in addition to honoring its prior commitments, the United States would grant to the State of Arizona two additional sections of land out of each township within the state for common school purposes. In total, the State (including the two sections per township previously granted to Arizona as a territory) was granted approximately 8,200,000 acres of land, or one-ninth of the territory of the State, for common school purposes. The sections selected by this legislation were Sections 2, 16, 32, and 36 out of each township. There were certain areas, such as sections covered by lakes, rivers, and Indian Reservations, where the Federal Government was not in a position to deliver the townships involved. Accordingly, the State was given what amounted to a "blank check" authorizing it to acquire from time to time other Federal lands not required for Federal purposes in lieu of the original land so designated. Although more than 90 percent of the 8,200,000 acres of land had been previously delivered to the State, there still remained some "in lieu" indemnity rights in the State of Arizona. The State in turn had enabling legislation which authorized it to sell parcels of land. Unfortunately, however, such sales provided that any person was authorized to acquire the land on the basis of 10 per cent down with the balance payable over a 25-year period, with interest at 5 percent per year.

A determination was made that the only feasible way of acquiring the necessary acreage was through convincing the State of Arizona—that is, the Governor and the state land commissioner—that the designation of the desired acreage was in the best interests of the State and would bring a substantial return to the State at public auction. The risk, of course, was that the State Government was required to hold a public auction, with an advertisement for bid extending over a 10-week period, and was required to sell the land to the highest successful bidder upon the terms indicated above. As the matter developed, the additional 13,000 acres were acquired by McCulloch on August 2, 1963, at the minimum bid of $954,329. Pursuant to law, the bidding was held on the courthouse steps of Mohave County, although only one person was bidding.

The Bureau of Land Management

The foregoing does not adequately describe the frustrations involved in clearing this land. All lands owned by the United States are held by the Bureau of Land Management of the Department of the Interior. When land is needed by a specific agency of the Federal Government, such as the Department of Defense, the Bureau of Reclamation, or the Bureau of Sport Fisheries and Wild Life, enabling legislation is created whereby the land can be withdrawn for the use of the particular department or bureau. Once withdrawn, the land remains under the jurisdiction of the particular agency until the withdrawal is lifted. Further, the same agency can withdraw on the same parcel of land several times; in addition, there may be withdrawals by several agencies on the same parcel of land.

Portions of the land at Lake Havasu City were subject at the time to four different withdrawals by the Bureau of Reclamation (January 1903, September 1903, June 1930, October 1931) and two withdrawals by the Bureau of Sport Fisheries and Wild Life for a national wildlife refuge (January 1941 and January 1949). In addition to the foregoing, a moratorium on transfers was declared by President Kennedy and Secretary Udall for 18 months, commencing in February 1961. Further, in June 1961, Secretary Udall announced the formation of the Lower Colorado River Land Use Office and Land Use Committee for the purpose of determining the utilization of all land bordering the Colorado River from the Davis Dam to the Mexican border—approximately 260 miles. Finally, grazing leases had been issued by the Bureau of Land Management on portions of the land, and thus it was necessary to persuade the Bureau of Land Management to cancel the grazing leases and allow the grazing lessee to institute appeals to the cancellation of his grazing rights.

The foregoing fairly well explains why it is not uncommon for the transfer of land through the

Federal Government to require five to six years to accomplish.

Obtaining Land from Individuals

Other parcels of land either have been or are being acquired by our corporation through negotiations with individuals. There can be no set method of negotiating these matters. However, in dealing with large blocks of acreage for a project which envisions the installment method of property sales, it is extremely important that a minimum amount in cash be paid for the property, and extended terms are mandatory if the project is to succeed. The rationale for this is quite obvious; every new project must have its initial opening "show," and, as lots are developed (grading, streets, water and sewer lines), cash must be paid for the installation of these utilities. In turn, the customer pays a minimum down, with the balance payable over seven to eight years. Because most of the first monies received go to the payment of sales commissions and incidental sales costs, such as transportation and customer feeding, it can be seen that the developer improves the lot for cash and, when he seels it to a customer, receives a piece of paper in return.

Financing New Communities

It can readily be seen that the financing of new communities is extremely difficult. Title IV of the Housing and Urban Development Act of 1968 facilitates such financing, but because it is extremely new, there is little, if any, experience relative to its provisions. Section 403 of that Act expresses this intent:

> To carry out the purposes of this title the Secretary is authorized to guarantee, and enter into commitments to guarantee, the bonds, debentures, notes, and other obligations issued by new community developers to help finance new community development projects. The Secretary may make such guarantees and enter into such commitments, subject to the limitations contained in sections 404 and 405, upon such terms and conditions as he may prescribe, taking into account (1) the large initial capital investment required to finance sound new communities, (2) the extended period before initial returns on this type of investment can be expected, (3) the irregular pattern of cash returns characteristic of such investment, and (4) the financial and security interests of the United States in connection with guarantees made under this title.

A developer usually solves his financing difficulties by one or a combination of the following methods:

1. Obviously the initial desire is to have the land seller accept little or no money down, with payments coming as payments are received from the ultimate purchasers of the land. Provisions are easily made whereby a title company or other third party can act as trustee. The land is placed in trust with the trustee, who in turn signs all contracts of sale of land, collects and disperses funds, and issues deeds to the property.

2. With a corporation listed on one of the nationally recognized exchanges, a stock exchange can be made for the land. Although this is often highly desirable from a seller's standpoint, because it is a tax-free exchange, the difficulty from the buyer's standpoint is that such an exchange depletes the equity holdings of the shareholders of the corporation, and the asset itself—namely the land that is acquired—is subsequently resold, and thus does not become a continuing source of new income.

3. In part, financing can be handled by means of municipal bonds. Many developers have attempted to cover all such costs by this method, but it is generally accepted that not more than 50 percent of the costs should be so handled.

4. In connection with the municipal entities, it should be added that Federal grants will become available, both for new communities under Title IV of the 1968 HUD act, and, through various other programs, for water and sewer lines.

5. Most developers attempt to reduce their cash outlay by providing that improvements will not be installed in the form of paved roads, water lines, and so forth, for a period of four to five years. This must also be fortified by a further provision that, in the event the lot builder wishes to build, the improvements will be installed to his lot in a reasonable period of time (such as 90 days after building plans have been approved by the local agencies) or providing in the contract of sale that the purchaser must either wait the required four to five years or substitute his equity in the lot selected for one in a designated area where development is occurring.

The subject of financing construction on the individual lots has not been discussed here, because McCulloch Properties has not to date been engaged in any actual construction, preferring to contract with local firms for such work. □

Smoke Rise of Kinnelon: A Club Community

by **John A. Talbott**

We acquired the beautiful 5000-acre tract of land known as Smoke Rise in an unusual, although ideal, way. It was my father's private estate and was essentially free and clear.

Originally, Smoke Rise was assembled in the late 19th century by tobacco tycoon Francis Kinney, of Sweet Caporal fame. The Kinney family had built many winding gravel roads through the entire estate and had graced the area with stone bridges and stone buildings such as a gate house, observation tower, barns, sheds, stables, a greenhouse and a large mansion overlooking 1¼-mile-long Lake Kinnelon. Smoke Rise is only 30 miles from New York City and closer to Newark, Paterson, and other business centers in New Jersey. In the mid-1940's my father found taxes and costs rising. He realized that the tremendous expense of maintaining such a huge estate was no longer practical, and so he had to decide whether to sell part of the estate or to develop. He consulted many developers and real estate people.

Planned as a Club Community

My father loved the wonderful variety of trees and the fabulous natural growth such as mountain laurel, wild azalea, dogwood, and shadblow. When he discovered that all the developers thought the only financial practical way to develop would be to create lots of modest size which would then require extensive clearing for model houses and for the erection of relatively low-priced summer and vacation homes, he decided instead, upon a plan to develop the whole estate as a club community wherein purchasers could enjoy the same kind of relaxing rural life known heretofore only by a few fortunate country squires and landed gentry. The sites were to be large enough to ensure privacy and allow preservation of most of the trees and shrubs. The expenses of maintaining the estate, converting buildings to club use, and creating new facilities would be shared by the development company and the residents.

The local and metropolitan real estate editors and real estate experts told us that the senior Talbot was being a starry-eyed idealist and that his development would not be a financial success, pointing to problems being encountered by Tuxedo Park and a few other similar communities.

Sources of Financial Support

My father's deep affection for the natural state of the area and his strong determination led him to go ahead with the plan anyway. Smoke Rise was started in 1946 with the land, family funds, and the additional financial aid of a blanket mort-

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John A. Talbott is President of Smoke Rise of Kinnelon, Kinnelon Borough, New Jersey.

gage (with suitable land release clauses) from the Prudential Insurance Company, which also supplied construction loans and permanent mortgages for homes for many years. Other insurance companies and banks later joined in supplying construction money and permanent mortgages.

Over the years Colonial Life and other financial institutions supplied funds to the company for working and expansion capital.

Acquiring enough capital to operate properly was time-consuming and difficult. Although New York City is probably the largest center of finance in the country, and although we were located less than an hour away so that access was easy, most of our negotiations with banks, mortgage brokers, and supposedly large and reliable financial institutions for good blanket financing led to a dead end (because of too short a term and too high an interest rate), or to suggestions of further endless negotiations after already having wasted valuable executive time, to say nothing of the time and money spent on accountants, attorneys, engineers and others for varieties of maps, engineering plans, projections, specialized presentation brochures, cash flow charts, overall development charts and plans, detailed figures of years of past performance, appraisals, and so forth. Some said yes, but could not handle such a large loan. Each lending group or institution usually wanted different figures worked out.

It is my opinion that this partially was due to a lack of knowledge and experience of our type of development on the part of many of the executives of institutions which might have provided the necessary financing, and also due to their belief that the lower priced, more usual developments offered faster and larger profits.

We could find no center of practical information, and that is why I was delighted to find out about the intention of the **BRAB Building Research Institute,** to serve as a clearinghouse for ideas and information concerning all aspects of our industry.

While searching for refinancing for necessary expansion, from 1960 through 1962, we made the mistake of taking interim financing for a short term at a high rate of interest. Shortly after this, in late 1962, my father died, and inheritance tax problems further complicated the situation. We should have delayed the road building and expansion until we finally secured the proper mortgage, as it would have resulted in a better cash flow and profit picture in the long run. Another two years were spent searching for a good, long-term mortgage.

Late in 1964, Mr. E. B. Leone, who has been in the lumber and building business for many years, joined us, and in fall 1965 we finally secured an excellent long-term mortgage commitment for almost $2 million from First Federal Savings and Loan Association of New York. Our mortgage is for a 6-year period; actually, it would have been better for the needs of our project if it were for a longer term.

General Development

It is my opinion that any large project which includes construction of expensive, individually designed homes must move at a comparatively slow rate of growth in conformance with a well-defined plan. We found that this type of development, a mortgage with sufficiently flexible terms is very difficult to secure in the New York area. I do not know if the situation has improved since 1965, but I do know that many planned and controlled new towns and new communities have been springing up throughout America.

Many prospective residents of Smoke Rise are persons who have transferred from other similar areas. By talking to these people, we have gathered that most of the other communities are on a smaller scale than Smoke Rise. Therefore, I suppose that financing for smaller mortgages is easier to secure.

The Smoke Rise Club is financially sound and operating well, and Smoke Rise of Kinnelon, N. J., Inc., the successor company to the Smoke Rise Company, continues to have financial stability. Present plans call for 3,500 acres to be used for the completed project. For the last few years, there have been more good customers than available homes. This has resulted in more and more homes being designed and custom built for families while they are in the process of transferring from other areas.

We encountered so many different terms and conditions concerning financing that it would be impossible to describe them all here. However, each new community project, if it is to be anything like ours, would have to tailor the releases, the so-called balloon at the end of the mortgage, the discount taken at the beginning of the term or monthly interest payments, and so forth, to its own needs. The money for the release of sections of land or individual lots which is deducted from the end of the loan is, in my opinion, the least desirable, because it is difficult to obtain a sufficiently long-term loan in the first place, and this merely serves to shorten the term. It is far better, if possible, to have a monthly minimum release provision which will provide for a steady amortization for the institution and will still be advantageous to the developer.

Land Planning, Roads, and Building Sites

The land and buildings were actually worth a great deal more than the mortgage we were seeking. Because the nature of the terrain, although beautiful, is very rugged and in many areas quite rocky, construction of roads and homes must be done by very competent people. The soil is good, however, and there is a profusion of trees and shrubs, because the area was never lumbered or spoiled by man's depredation.

Some parts of Smoke Rise, including the lake are 600 or 700 feet above sea level. The ridges and hills are at 1,000 to 1,100 feet elevation and afford magnificent views, not only of Lake Kinnelon, but of distant hills in the Newark and Jersey City watershed areas which surround Smoke Rise. In this natural buffer area, which consists of more than 100,000 acres, there are also two large reservoirs which can be seen from some of the higher points of Smoke Rise.

Land planning, so as to take the best advantage of natural contours, views, and so forth was particularly important. For many years, Smoke Rise had its own staff of engineers constantly on the payroll. Each lot had to have a good building site, a good driveway site, and a suitable site for a septic system.

Originally, our own crews built the roads, while other crews, also working for the Smoke Rise Company, built houses. During our 22 years of existence we have tried many different methods but finally found that it was more economical to use engineers who also had other work to keep them busy when we were not using them, and this turned out to be true for the road contractors as well. We originally kept a crew and equipment to do the snow plowing and sanding of the private roads, and the cutting of trees on view lots, road maintenance work, etc.

Smoke Rise Club

The Smoke Rise Club, which operates like many good country clubs, became financially stronger as more people joined and took over activities and expenses originally paid for by the developer. The club now has its own office and staff and some of its own equipment and crew, which are augmented by outside contractors. There are approximately 30 miles of private, paved roads within the community and there are two gates, manned at all times by gatemen paid by the club. There is an initiation fee, which goes toward capital improvements, and club dues and assessments which pay all other expenses.

The company built a fine large beach on the spring-fed lake, also docks and a bath house. The club has expanded the facilities and services. It has life guards, activities directors, and the largest single Sailfish fleet in America, of over 100 boats. The National Sailfish Regatta this year will be held in August in Smoke Rise.

The club is run by a combination of a board of trustees and a board of governors. The trustees are still controlled to some extent by the company, and the governors are elected by the membership. The membership must pass each year on the assessment and all other vital items of this type. The club capital and operating expense budget this year is substantial.

Mutual cooperation for achievement of mutual goals has led to a remarkably harmonious existence all these years, and the approximately 600 families now in residence have numerous committees to control various activities, which include hunting, fishing, riding, swimming, tennis, camping, and numerous social activities.

The Need for Flexibility

At times the company did most of the building, and at other times it did none—while experimenting to try to find the best technique for progress and financial stability. During the last 10 years, we have found that doing part of the building ourselves and having a group of company-supervised and approved builders do the rest seems to be the best formula for our particular community. The houses range in value from about $50,000 to $175,000, and the new houses being built fall mostly between $70,000 to $120,000, including land.

Consultants

To be sure that we are handling our planning, financing, and developing well, we occasionally employ the services of some well-known management consultant firms. Although some areas of the objective look at ourselves are useful, I consider our judgment better than theirs in most areas, except financing. Financing is a very specialized field when one is dealing with requirements for a million or more dollars, and professional assistance and advice can be very valuable to the developers.

The Need for Creativity

My comment in closing is that, although we have found borough and county boards and officials generally helpful, our opinion is that there is not much encouragement and no really positive assistance on the part of most financial institutions or State and Federal Government for developers who want to go beyond the mediocre in taste and imagination in architectural design and community planning.

For all developments, there should be larger sites; better house design; extra recreation facilities; creative landscaping, using the best trees and shrubs already present as a base; and more attractive environment, enhanced by large areas left in their natural state—all of which has been done at Smoke Rise. Rural areas are gradually being cemented over to become new concrete suburbs, stamped out with the cookie cutter of conformity with past mistakes.

Many developers, in my opinion, are lost in an abyss of abominable mediocrity—probably because it is more profitable. Something should be done to make it more profitable and desirable for developers to be creative. □

Open Forum

Question: A question by an unidentified participant concerned the efforts of new town developers to preserve the area's ecological balance.

Mr. Talbott: In our area, we thin out trees and shrubs rather than cutting them down and then having to try to propagate them. We preserve as much of the natural vegetation and pleasant open spaces as possible at Smokerise. We have given to the club areas covered with hemlocks or mountain laurel, of a particularly beautiful growth.

Mr. Krechter: Lake Havasu City has a desert climate, as you know. However, we have soil, not sand, and it will grow anything as long as it has water. Unfortunately though, we do have extremely hot summers. The temperatures in the summertime in Arizona will go up to 110 or 115 degrees. Most plants will not survive such heat.

But one of the first things we did was to purchase 2,000 palm trees. Naturally, palms grow in the desert, and they look good there.

Initially we also brought other plants from California. We tried to induce a nursery to come to Lake Havasu during our first few years, but we were unsuccessful. About 3 years after the development started, a nursery opened in the area and has been quite successful, so the vegetation is increasing rapidly.

Mr. Thompson: Mr. Herberg, is anything done at Snowmass to improve on nature?

Mr. Herberg: At Snowmass there is no need to improve on nature. Instead, we try to do as little harm as possible. Snowmass is in what is called a high desert. The north side of the mountain is dense with aspen and quite a bit of pine. The south face of the slope is quite dry and therefore has scrub oak, sage, and vegetation of that sort.

Ecological studies that we had made of the area —in order to determine what the impact of development would be—showed that restoration of growth on the south facing slopes is something that may never occur unless it is sponsored by man, because the growth in such areas is a marginal type. Therefore, we have been particularly careful on those faces not to disturb the existing growth any more than necessary.

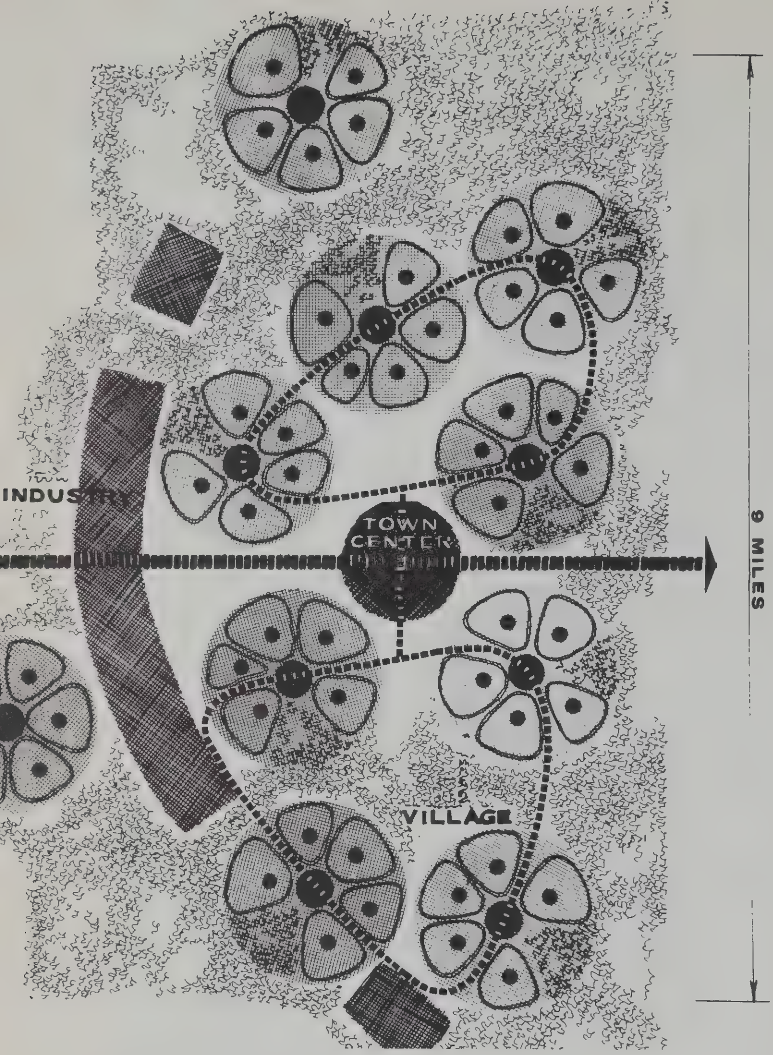
We are clearing a lot of trees in order to provide ski trails; we replant many of these trees, although in theory, mature trees cannot be replanted. You have to have root and soil conditions similar to the environment they are taken from in order for the transplant to be successful.

We also have a small nursery for introducing new types of vegetation that are not native to the site but which can be grown there.

Comment: A comment by an unidentified participant brought out two interesting points.

The Urban Development Corporation, of New York State, is the only one of its kind in the country. It is, in effect, a statewide urban renewal agency with all of the powers that renewal agencies generally have, including overriding local ordinances. People who are asking for help concerning the development of new towns appear to be asking for governmental help, be it local, State, or Federal. One of the possibilities that might be explored is a corporation such as UDC.

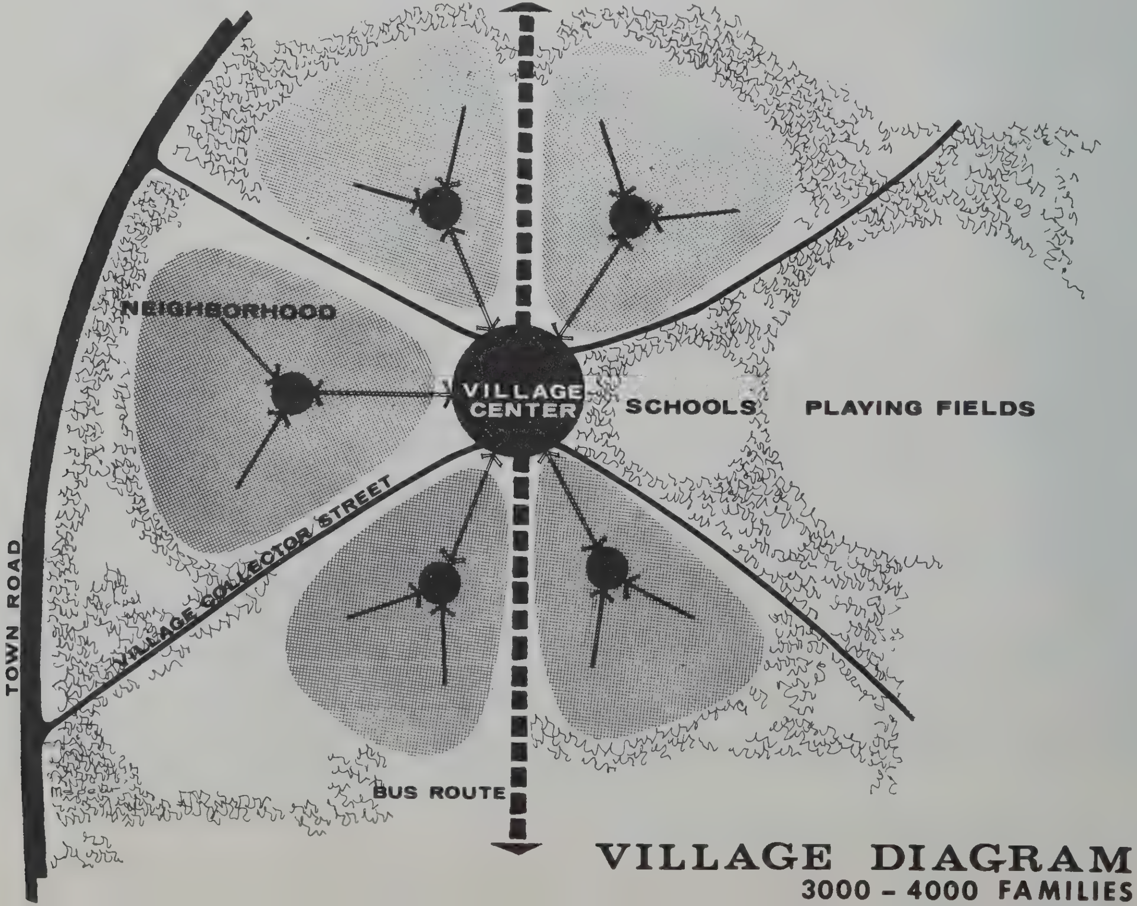
Also, a combination of efforts—public resources, complemented by private know-how (as represented by the people here, particularly on the panel)—could be mutually beneficial.



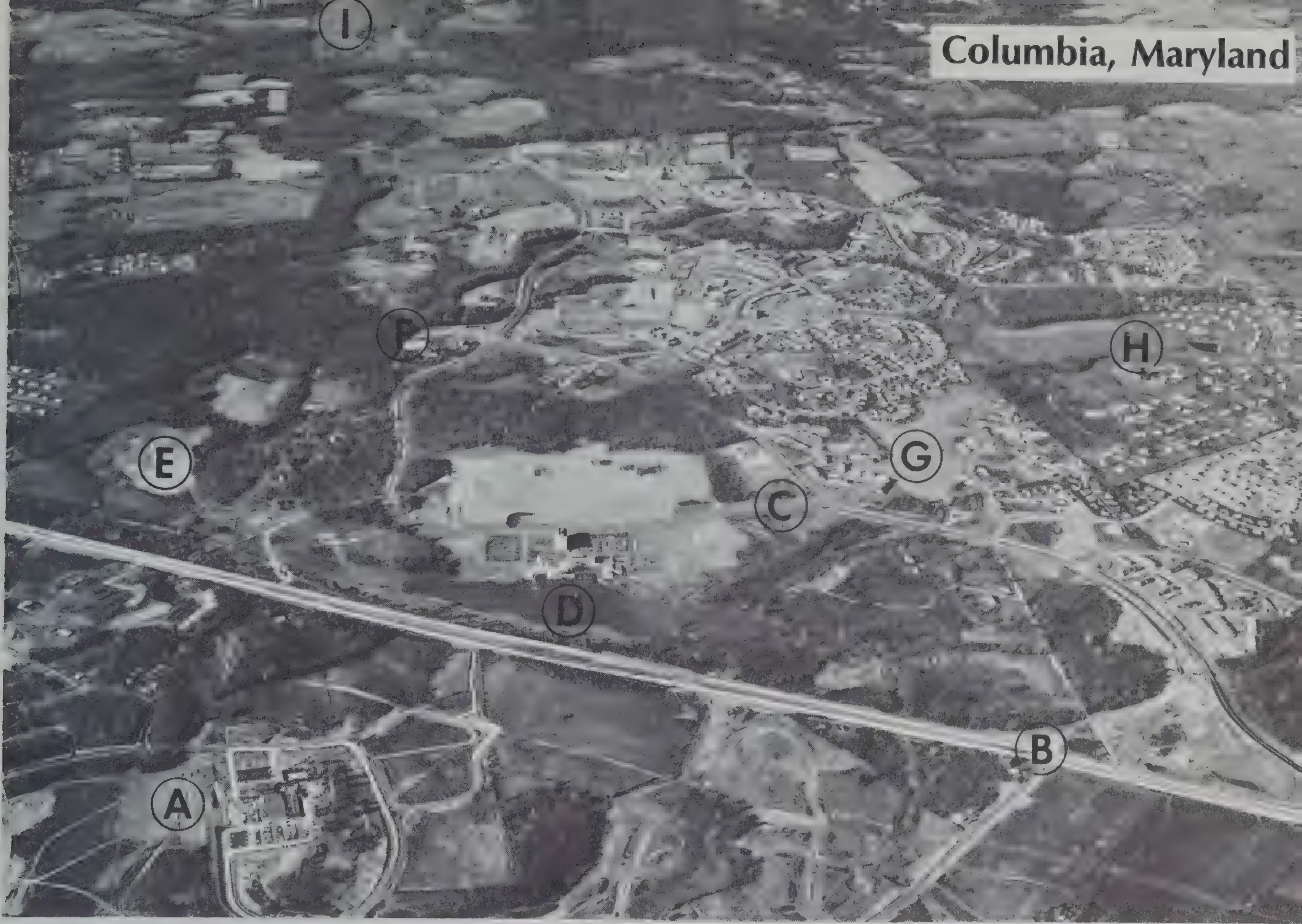
The People Tree, a sculpture in Columbia's downtown plaza, is a symbol of the new town.

This diagrammetric plan for the development of Columbia shows the relationships among the town center, the initially proposed 10 villages (7 now are planned), and industrial areas. The dotted line connecting two groups of four villages with the town center shows a minibus route. Three to five neighborhoods—each with a neighborhood center for convenience shops, an elementary school, and recreation facilities—comprise each village.

This diagram outlines the major aspects of a village in Columbia. The vehicular traffic system discourages all except local traffic from using neighborhood streets, which feed into village collector streets, and from them to the arterial streets (or town roads, as shown here); only the town roads connect with highways running through or adjacent to Columbia. Junior and senior high schools and related playing fields are near the town center. Green spaces separate the various segments of the village, and larger green areas define the villages, the town center, and the industrial areas.



Columbia, Maryland

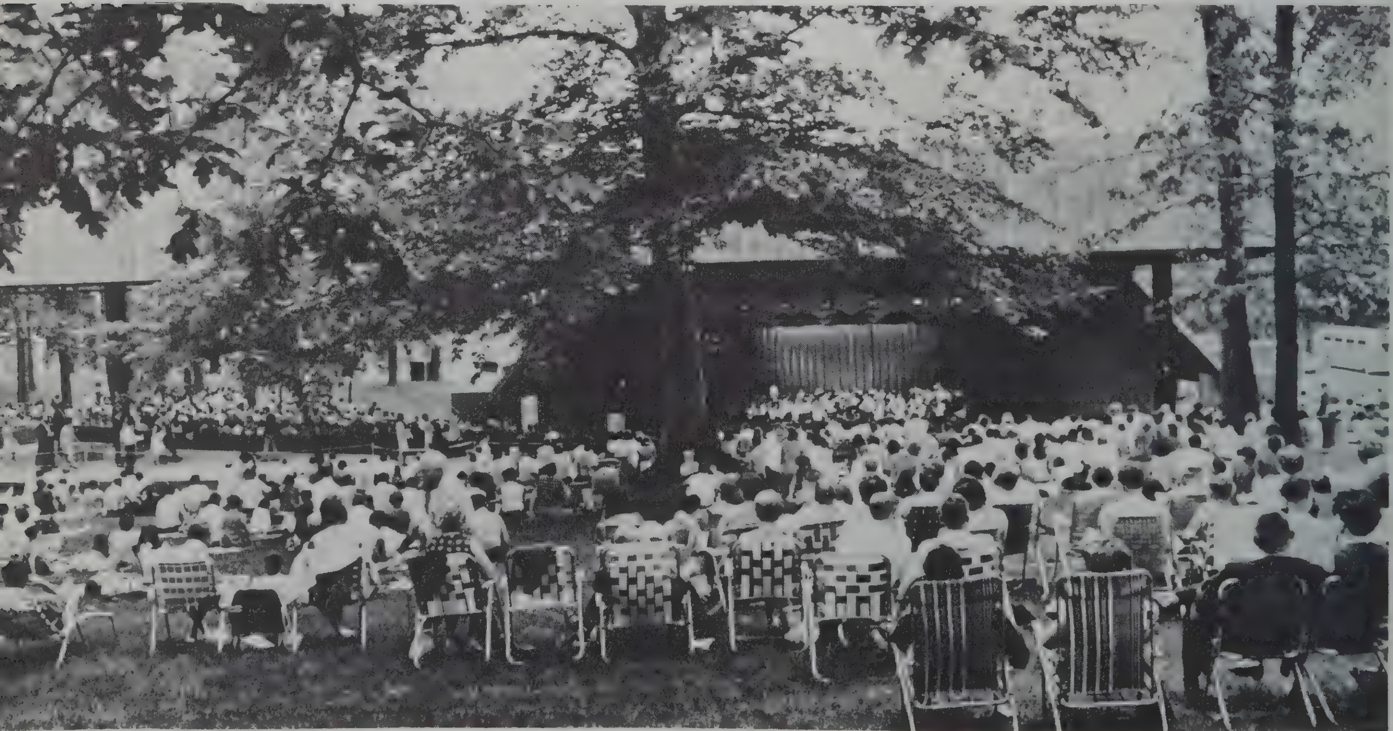


In this oblique airphoto (November 1969), the major features of Columbia after 2 years of construction are easily seen. (A) Oakland Mills Village Center; (B) U.S. route 29 (Baltimore is 30 minutes away, to the right; Washington, 40 minutes, to the left); (C) Columbia's major road, a parkway; (D) Lake Kittamaqundi and the first office building—the large clearing just beyond is the site of "downtown" Columbia; (E) Symphony Woods, in which the Merriweather Post Pavilion is located; (F) Wilde Lake Village Center; and (G) Wilde Lake (both lakes are stocked with fish and both are dotted with small sailboats, rowboats, and canoes during much of the year). (H) This subdivision, built earlier and not a part of Columbia, vividly illustrates the way land is wasted in a typical subdivision; compare this with any of the presently developed sections of Columbia—where housing is grouped, thus saving land area for usable open space. (I) Woods and fields of still rural areas in Howard County, Maryland.

One of Columbia's minibusses.

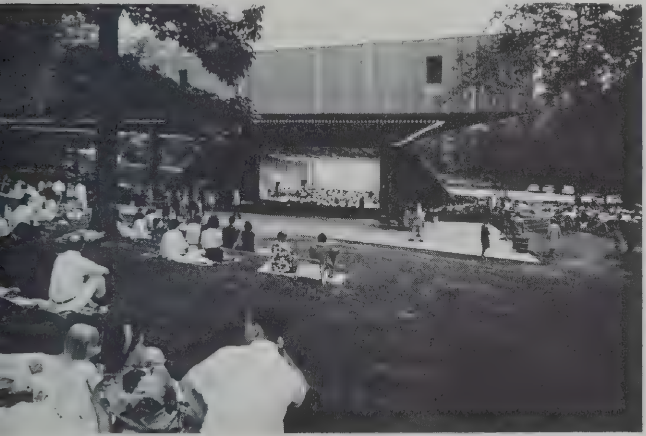
Above—Wilde Lake Village Green, shown here, is in the first of Columbia's village centers. It has the form of an open-end triangle. The village center includes a variety of shops of the type frequently visited during the week, a community building with varied size meeting rooms, a small auditorium, and some recreation facilities; and professional offices.

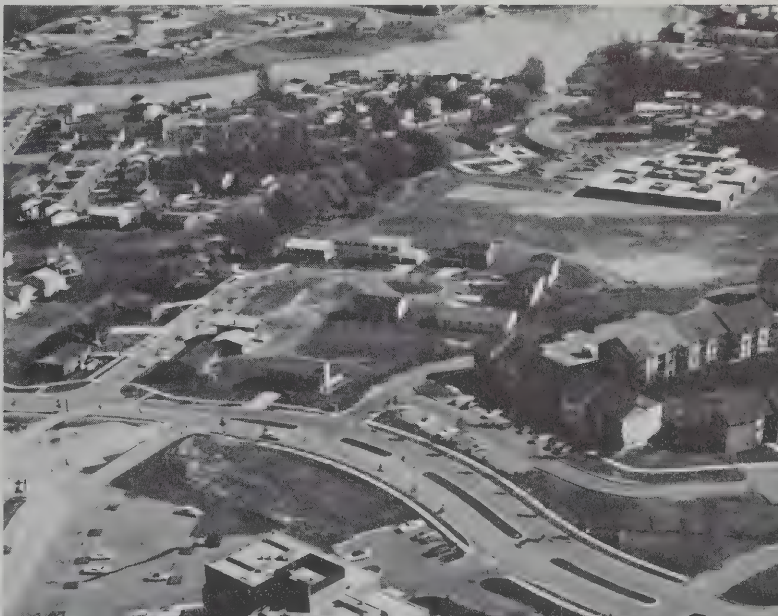
Below—The Merriweather Post Pavilion in Symphony Woods provides acoustical excellence for summertime musical performances from rock to Bach. The roof shelter seats hundreds; others sit on the grass or bring their own chairs.



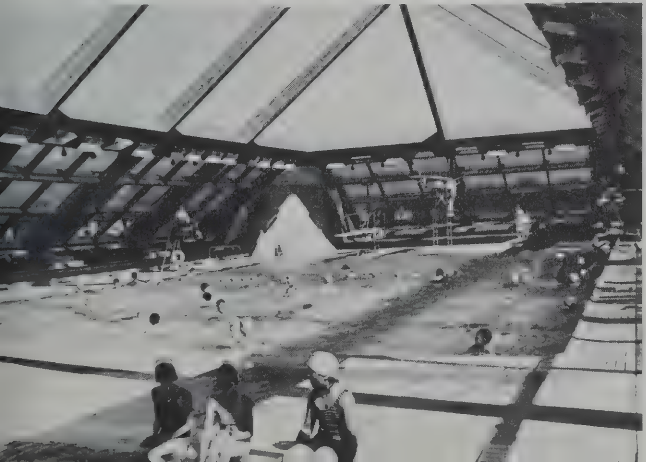
Above—Downtown Columbia at dusk, reflected in the waters of manmade Lake Kittamaqunde.

Below, left—Housing in Columbia is varied. High-rise (Concord House at lower left), garden apartments (Bryant Woods at center right and the Cove, upper right), and single family houses. Bryant Woods playing fields, elementary school, and neighborhood center (convenience shop, snack bar, meeting rooms), and Wilde Lake also are shown.





Simple recreation facilities have been planned. Each neighborhood has an outdoor pool; each village is to have a pool that can be used throughout the year. The Wilde Lake Village pool, shown here, is heated in winter and has a plastic roof that can be retracted to open the pool to summer sun and breezes.

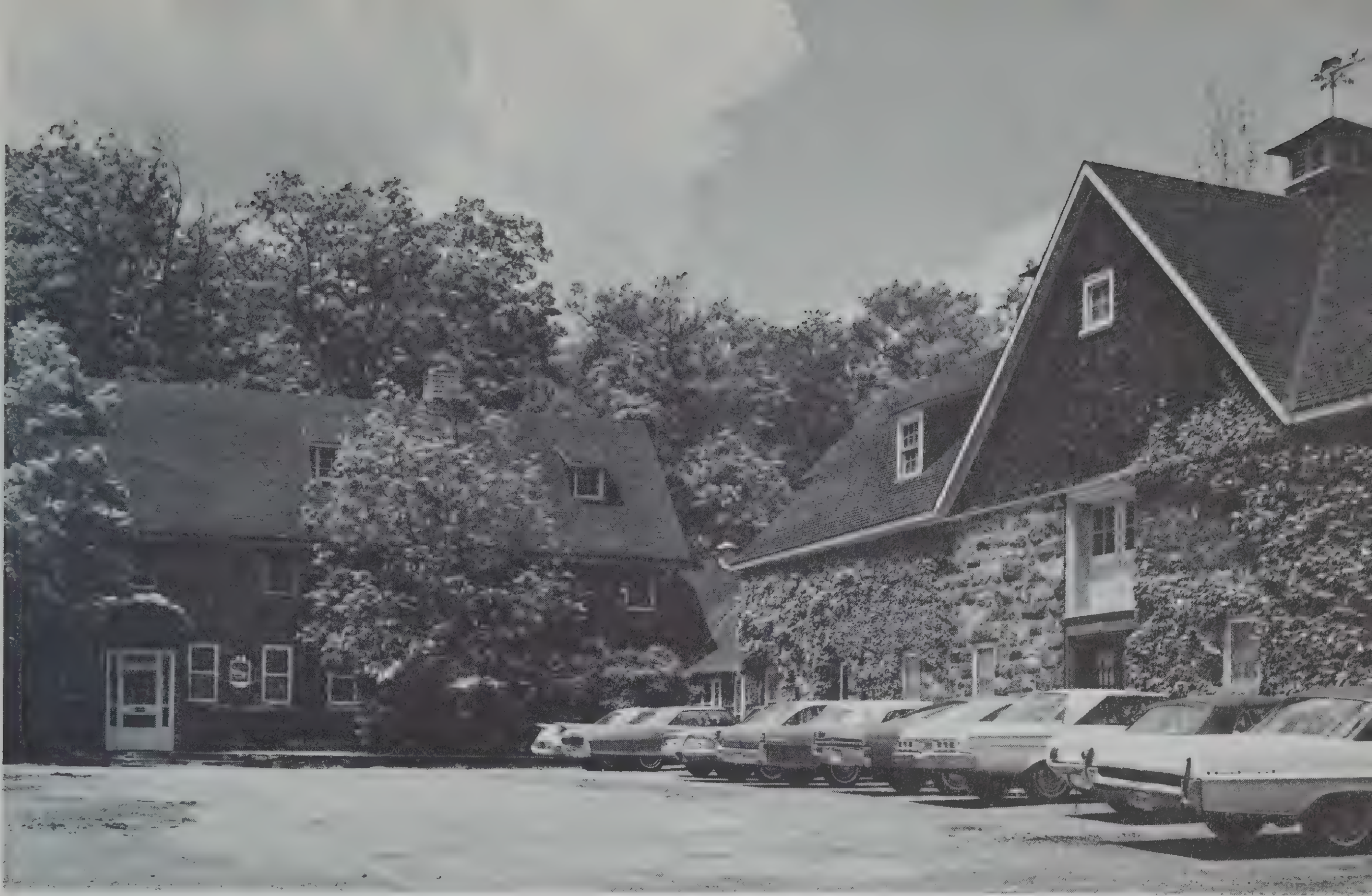


Smoke Rise, New Jersey

Above—Smoke Rise of Kinnelon, New Jersey, a 5,000-acre club-plan residential community, commenced in 1947, might well use this picture to illustrate its uniqueness. Everything usable that was on this former private estate has been retained, and new roads, houses, and recreation facilities have been fitted into the scene. This new, ground-hugging one-story house in a heavily wooded area contrasts with the 65-year-old observation tower dominating the area from the top of Kitty Ann Mountain. (On a clear day the skyscrapers of Manhattan are visible from here.)

Below, left—St. Hubert's Chapel, on an island in Lake Kinnelon at Smoke Rise, is symbolic of the era when the property was privately owned. Today the 131-acre lake and its shoreline are reserved for the use of the entire Smoke Rise community.

Below, right—The old stables have been retained. Miles of trails in hilly, unspoiled woodland make horseback riding a favorite recreation in Smoke Rise.

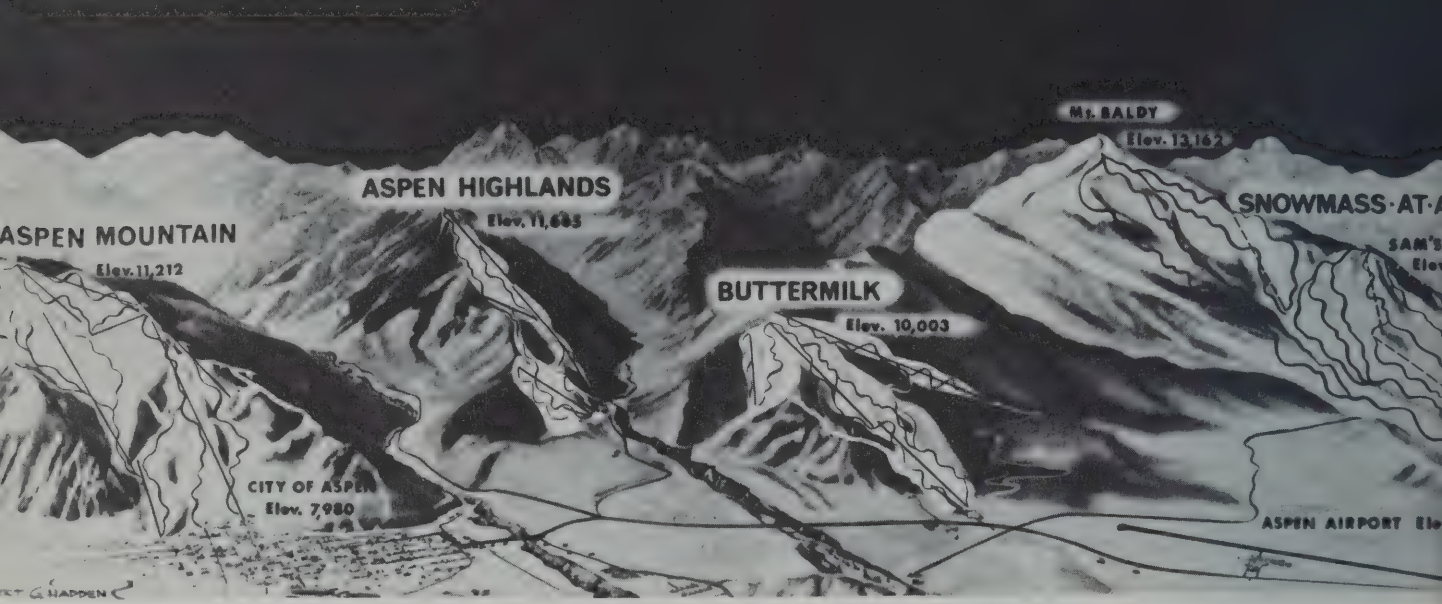


Above—The steep roofed cattle barn, remodeled, became the Village Inn.

Right—A stone outbuilding has been transformed into a library. (And the piggery is now a youth center!)

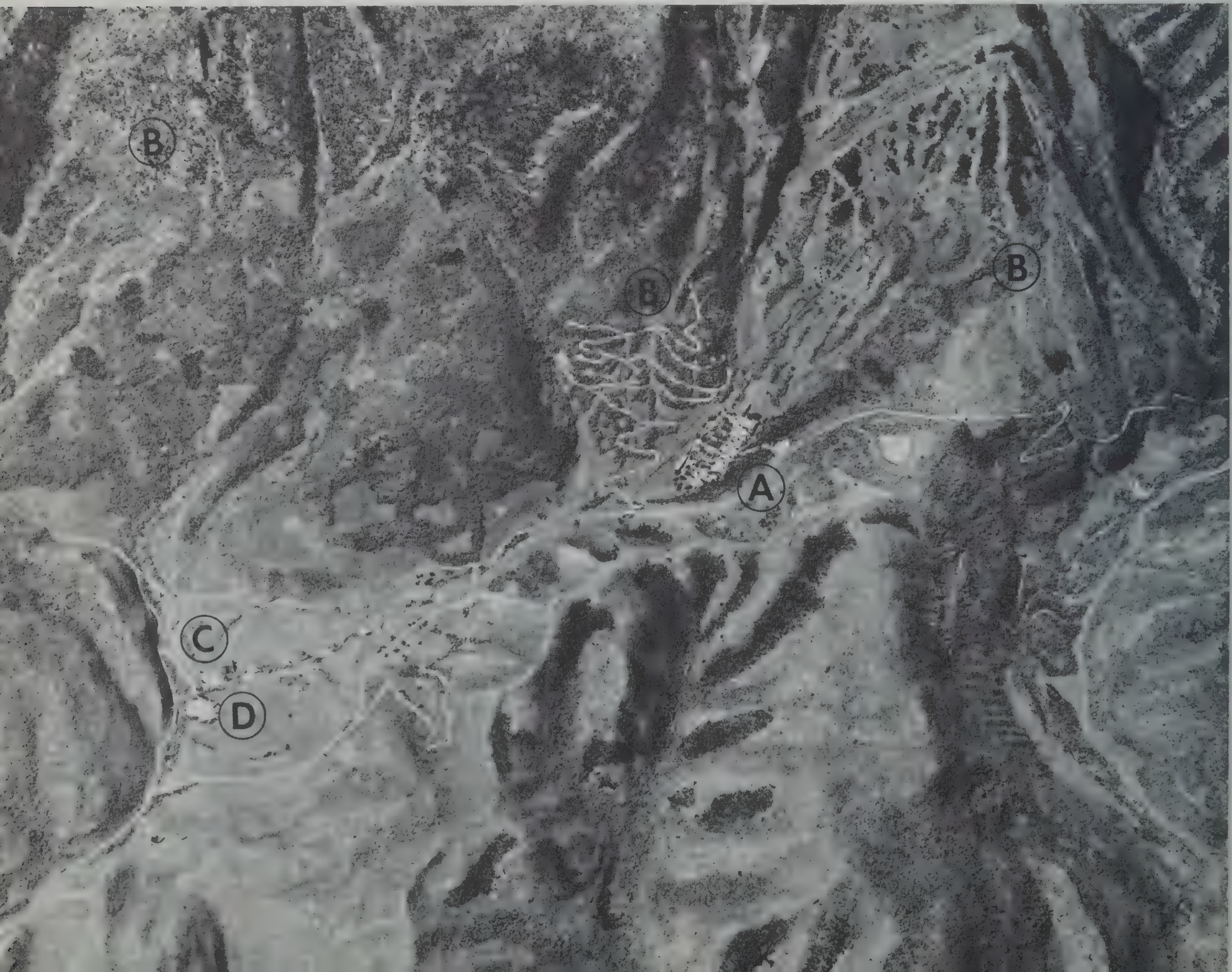
Below—Smoke Rise is characterized by one statement: "Created by nature, preserved by man." Roads follow contour lines, houses are tucked into the slopes, and no tree is cut unnecessarily.

Snowmass, Colorado



Above—An overall schematic of the entire Aspen skiing complex showing Snowmass-at-Aspen in relationship to the other three skiing mountains in the area.

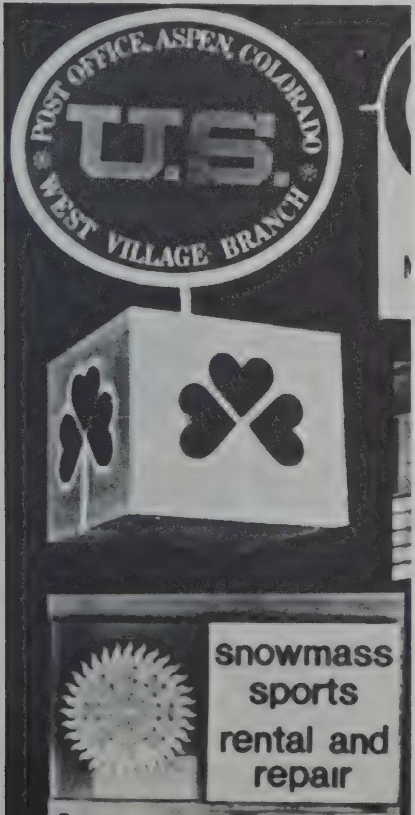
Below—This airphoto (1969) provides a bird's eye view of the site of Snowmass-at-Aspen. The letters indicate the general plan for its development; (A) West Village; (B) the first ski slopes developed; (C) the equestrian center; and (D) the golf and tennis club.

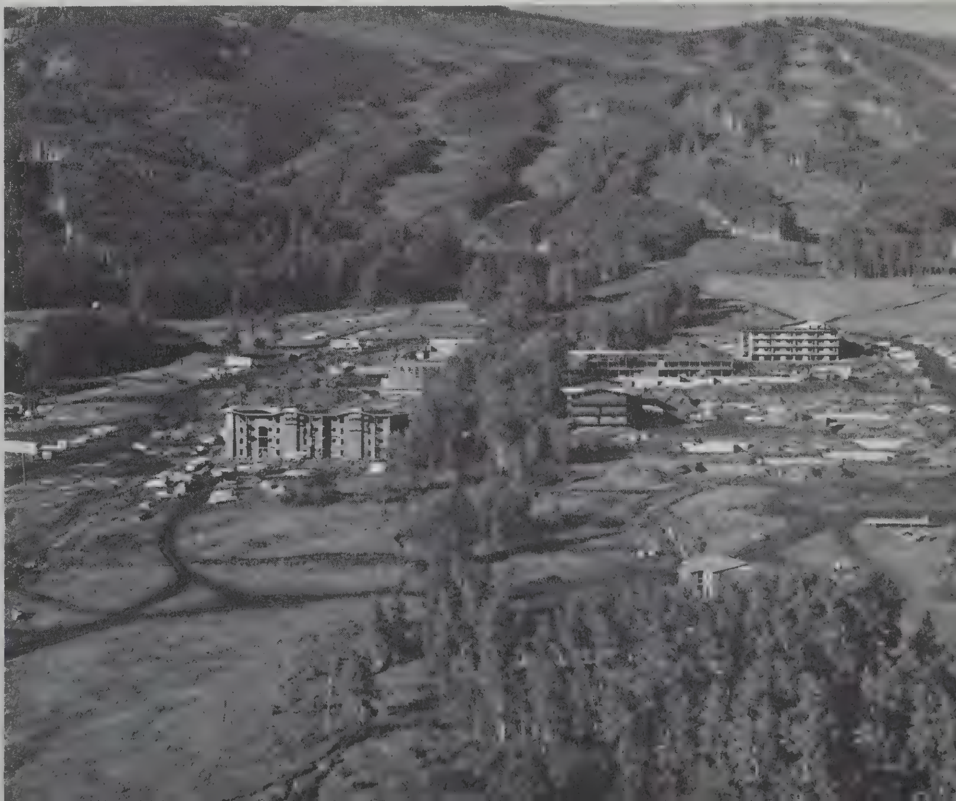


Above—One of the seven double chair lifts currently in use at Snowmass. This overlooks the site of West Village, near the bottom of the slope, and the Brush Creek Valley.

Below, right—This low-oblique airphoto (July 1967) shows West Village in an early state of development. Lodges and condominiums are under construction and the parking lot for the village (at right edge of photo) has been rough-graded. Clearings in the forest up-mountain from the village are the first ski slopes developed at Snowmass-at-Aspen.

Below, left—Signs in Snowmass are closely controlled by the Architectural Control Committee. These are examples of signs used in the West Village.


POST OFFICE, ASPEN, COLORADO
U.S.
WEST VILLAGE BRANCH
snowmass sports rental and repair

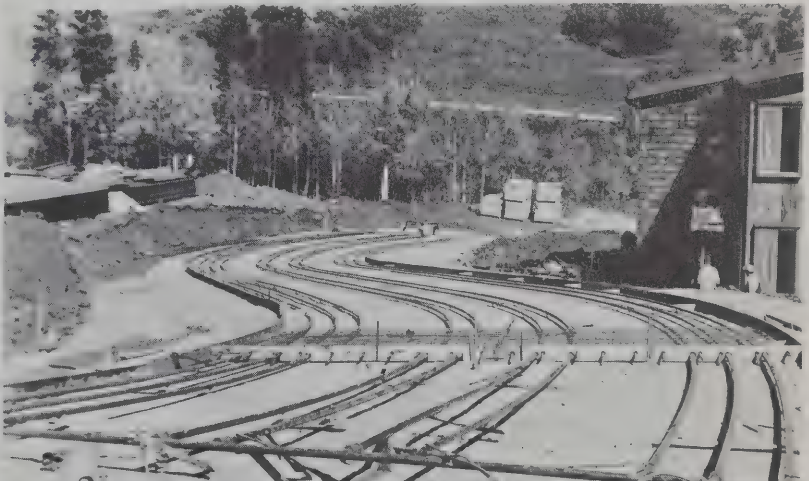


Above—Requirements concerning the general plan, site plan, architectural design of individual structures, exterior construction materials used, and landscaping, together insure that structures at Snowmass harmonize with their natural surroundings. This photo shows the Shadowbrook Condominiums in West Village.

Below—West Village Square has a post office; a delicatessen; clothing, sports, and gift shops; a beauty shop and a barber shop; a laundry-dry cleaning center; a day-care facility for kindergarten-age children; and a variety of places providing food and entertainment. The interior of the square is limited to pedestrians, as is most of West Village. Automobile (and truck) loading and unloading space adjoins the Square; the Village parking lot, with a gasoline service station and a car rental service are near one side of the Square.

Many summertime recreational facilities are available in or near Snowmass-at-Aspen. Popular activities include (Above) horseback riding on Snowmass property and in the adjacent 2,076,000-acre White River National Forest, (Below) golf on a championship course, stagecoach rides, and swimming in one of the 11 heated pools in West Village. In Snowmass there is a theatre, with performances by a repertory company in July and August, and a school for arts and crafts.

Below—Because of winter snow and ice conditions, roads in Snowmass have a grade of less than 8 per cent. However, West Village has a 14 per cent grade. The problem of maintaining good winter driving conditions was solved by constructing a unique "snow melt" road. The heating coils shown (the photo was taken during construction in 1967) contain a mixture of water and glycol; the system will melt snow at the rate of 2 inches per hour.



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